SCIENTIFIC AMERICAN

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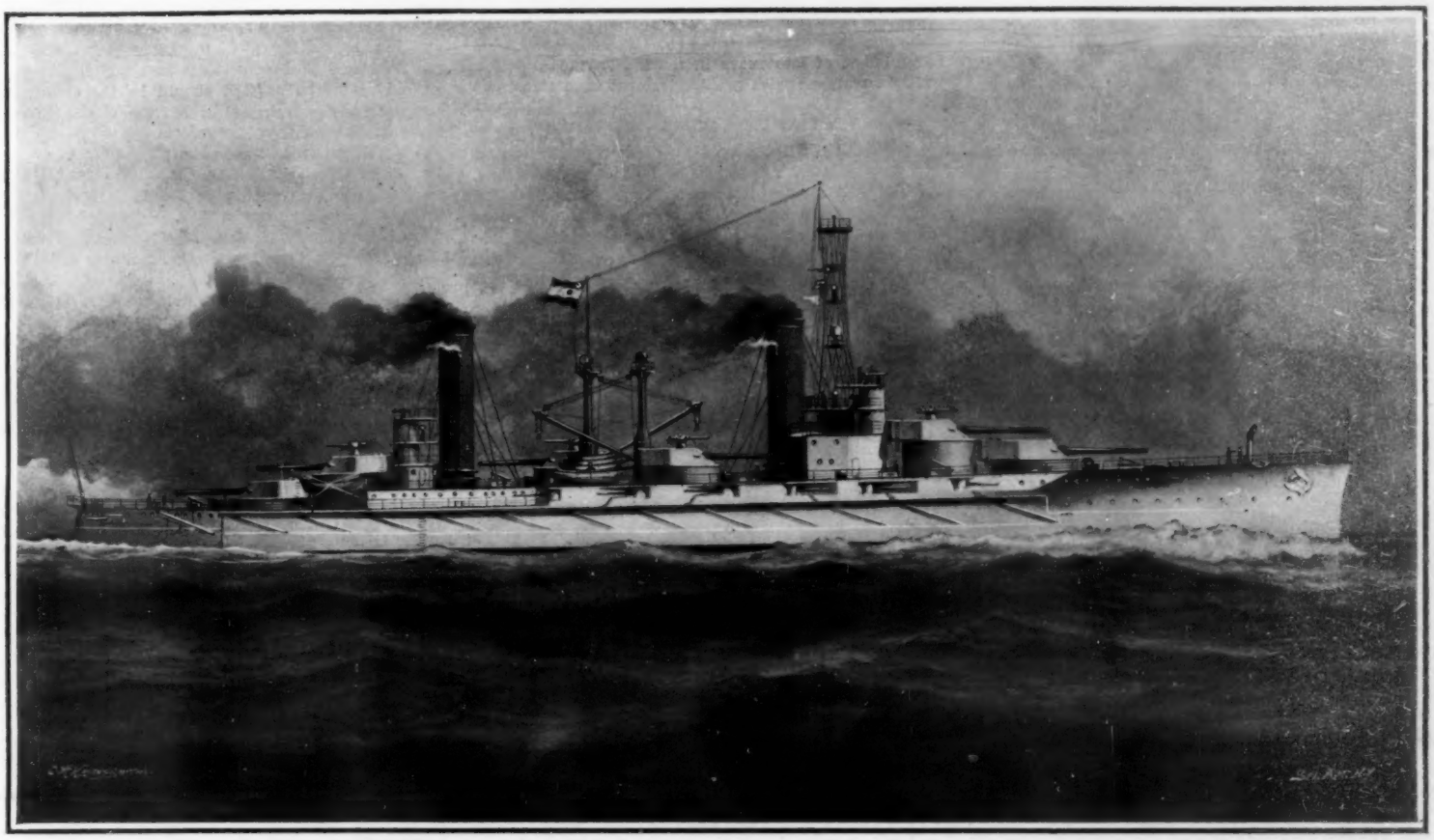
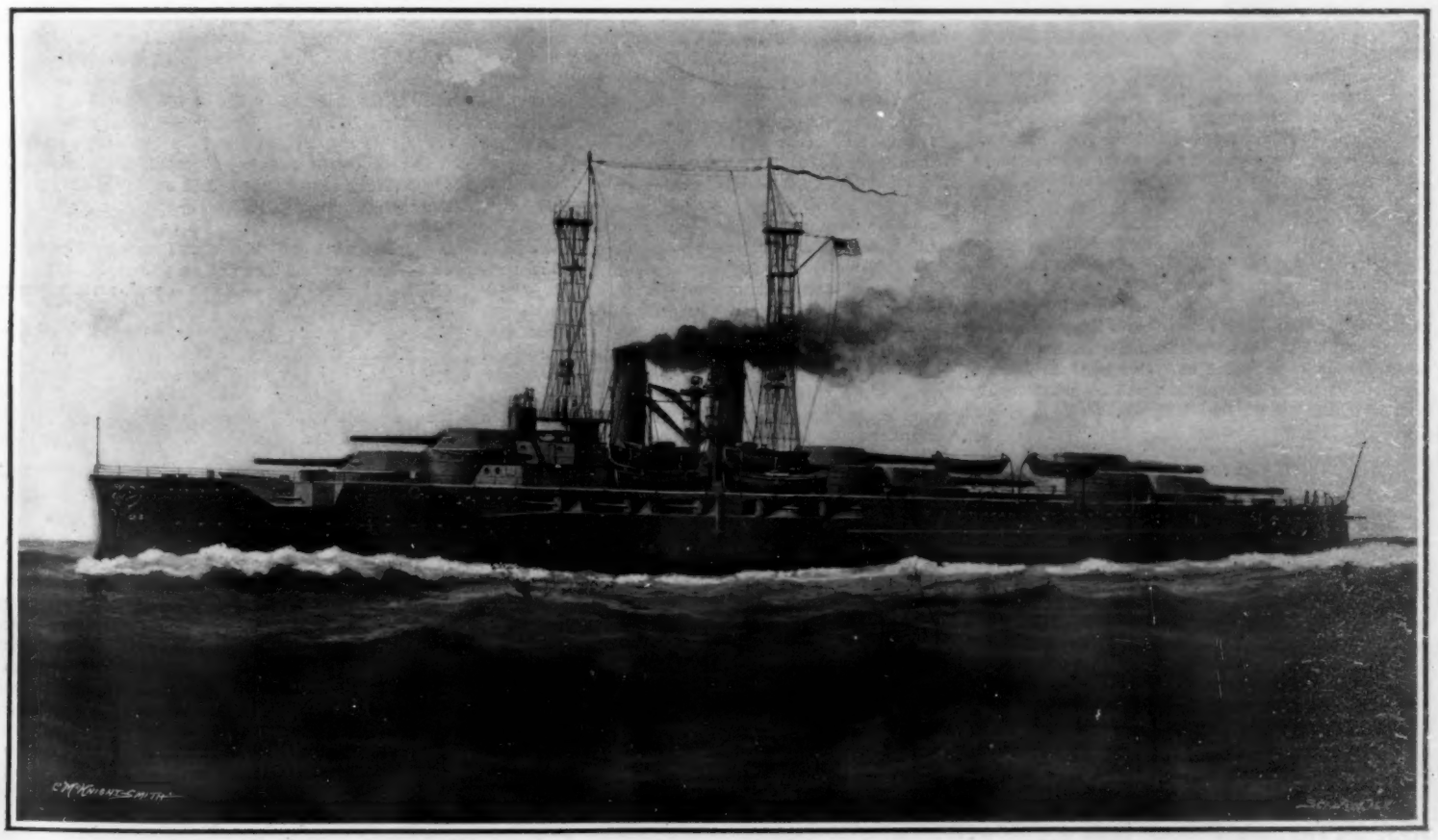


Length over all, 585 feet. **Beam,** 98 feet. **Full load draft,** 30 feet. **Full load displacement,** 30,200 tons. **Speed,** normal draft, 22½ knots. **Maximum coal supply,** 4,000 tons. **Radius,** at 11 knots speed, 10,900 knots. **Armor:** See armor plan, page 158. **Guns:** Twelve 50-caliber 12-inch; twelve 6-inch; twelve 4-inch. **Torpedo tubes,** two 21-inch.

"Rivadavia" and "Moreno," Argentine Dreadnoughts building in American yards.



Length over all, 554 feet. **Beam,** 93 feet 2¼ inches. **Full load draft,** 29 feet 8 inches. **Full load displacement,** 27,943 tons. **Speed,** normal draft, 20¾ knots. **Maximum coal supply,** 2,500 tons. **Radius,** at 10 knots speed, 8,000 knots. **Armor:** See armor plan, page 158. **Guns:** Twelve 50-caliber 12-inch; twenty-one 5-inch. **Torpedo tubes,** two 21-inch.

"Wyoming" and "Arkansas," building for United States navy.

THE FOUR POWERFUL DREADNOUGHTS UNDER CONSTRUCTION IN AMERICAN YARDS.—[See page 158.]

SCIENTIFIC AMERICAN
ESTABLISHED 1845

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NEW YORK, SATURDAY, AUGUST 27th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE AIRMAN AND THE BIRD.

AVIATION is progressing with bewildering rapidity in these days, and the achievements of the past fortnight have been of such a character as to set at rest all doubt of the broad usefulness of the aeroplane, and its ultimate and complete mastery of the air ocean above us. The most important event was the bold cross-country race in France, in which a total distance of 485 miles was covered in six stages at an average speed of 40 miles per hour. The significance of the performance of the winners lies in the fact that they started on each day's successive stage of the journey quite regardless of the weather conditions, and made each destination successfully, although on one occasion they were battling with a heavy wind-storm in a deluge of rain.

It was inevitable that when aeroplane flight had been developed to a certain point of speed and safety, comparison should be made between the flying machine and the bird, and the opportunity presented for such a comparison in the recent French contest was utilized by releasing a flock of carrier pigeons at the same instant that the competitors started on the 48½-mile leg of the course from Douai to Amiens. The carrier pigeon is one of the swiftest of birds; yet the winner reached Amiens over six minutes ahead of the first pigeon. The carrier pigeon, it is true, is credited with being able to do 60 miles an hour, more or less; and, of course, the homeward flight of these birds was not done at maximum speed. Neither, indeed, was the flight of the airmen, yet the result emphasizes in the most dramatic way the wonderful advance in speed that has been made in the art of human flight. At the last Rheims meet, a Blériot monoplane averaged in one race nearly 70 miles an hour, and the time is near when the airman will be able to make the boast that not even the wild goose, the wild swan, or any of the swiftest of nature's birds, could give him their aerial dust in a straightaway flight.

Those of us who believe that touring by aeroplane is another possibility of the near future will find abundant confirmation of their faith in the recent daring flight of a young American from Paris to London with a passenger aboard. The lesson of that adventure is that with a perfected motor and the provision of frequent and clearly marked landing places, touring by aeroplane will be a thoroughly feasible sport.

ADVENT OF THE OIL-ENGINE-DRIVEN OCEAN STEAMSHIP.

IT is fitting that the Germans should be the first to launch a large ocean steamship propelled entirely by internal combustion motors, and the Hamburg-American Company are to be congratulated upon their courage in making this venture in a vessel of 8,000 tons. The readers of the SCIENTIFIC AMERICAN have been made familiar during the past few years with the experimental work done by German engineers in the propulsion of small vessels, barges, etc., in the endeavor to produce a satisfactory internal combustion engine for marine work, and it is gratifying to learn that the outcome of this and other investigations has been so satisfactory as to warrant the application of the system upon this ambitious scale.

The new vessel will be fitted with two Diesel engines, each of 1,500 horse-power, which is a big advance upon one of 500 horse-power, the largest marine engine of this type, hitherto mounted in a vessel. The fuel, a petroleum residue, the cheapest grade of oil, and one easily obtained on both sides of the Atlantic, will be burned directly in the cylinders; and it is expected that the power will be sufficient to drive this 400-foot cargo steamer at a speed of about 11 knots.

Sentiment does not enter into the motives which have prompted this ambitious venture. It was done solely under the spur of that guiding principle, economy, which is behind all improvements in steamship transportation. There will be a great saving of space; for not only will the heavy and bulky boilers be omitted, but a large proportion of the bunker space also will be available for the stowage of cargo. The problem of securing and controlling the stokers, one of the most troublesome features in running a steamship, will no longer cause anxiety in the owners; for the engineers and a few oilers will constitute the whole of the engine-room staff. There has been no experiment of late years in marine engineering that will be watched with greater interest than this.

DUST PREVENTION ON PUBLIC ROADS.—I.

ALTHOUGH the problem of dust prevention on public highways is by no means a new one, its importance has been greatly accentuated by the comparatively recent introduction of the automobile. The dust-raising tendency of the latter is due to the destructive shearing action of the tires of the driving wheels and the intense suction and eddying-producing effect of the car body in passing swiftly over surfaces which have been already loosened up by tire action. In the days of the horse-drawn vehicle, the iron shoes of the horse and the tires had a tendency to consolidate, rather than loosen up, the surface of a well-made macadam road, and the comparatively small amount of dust which gathered could be sufficiently laid by one or two daily trips of the watering cart. The advent of the automobile, however, has complicated the problem greatly, and it has become necessary not merely to find a more efficient means for laying the dust, but to provide also a method of road construction which will more firmly bind the road material together, and enable it to stand up under the extreme conditions which the automobile has imposed.

The work which has been done during the past eight or ten years in this direction has provided much valuable data on the action of dust preventives, both as to their temporary effect in laying the dust, and their more important action as permanent binders of the materials of which the roads are built up. Generally speaking, these results are highly encouraging; for it is now understood that the failures which have occurred were due to a lack of knowledge of the quality of the oils and other binders employed, and a failure to grasp the now well-understood fact that, for successful road treatment, a study must be made of the composition, both of the oil itself and of the surface to which it is to be applied.

For the genesis of this work, we must go to France, where, as far back as 1867, the problem was made the subject of investigation. It was not, however, until 1902 that the work was seriously undertaken, and in the last eight years a large amount of theoretical and practical work has been done in Europe, mainly in France and England. In these countries an almost exclusive use has been made of tar; but here in the United States, chiefly because of our large supplies of oil and its general availability, oil has been the medium generally employed. In both the Old World and the New, the results, as noted above, have been highly encouraging; and the indications are that with our rapidly increasing knowledge of the subject, and the general introduction of practical methods and suitable appliances, not only will the problem of dust laying be thoroughly mastered, but a type of road surface will be developed, which will stand up better under the new and severer conditions of traffic than did the old macadam and dirt roads in the days of the horse-drawn vehicle.

The most valuable quality in any dust preventive is its ability to hold together the finely divided material which is produced on or near the surface of the road. The value of any oil, asphalt, emulsion or what not, lies, at the last analysis, in its "binding power"; and this quality in any dust preventive is proportionate to the amount of bituminous base which it contains.

The work of dust prevention divides itself, according to the aims and methods employed, under the two heads of permanent and temporary. The first method, and the most effective, is to so thoroughly treat the surface that it will be firmly and permanently compacted, its disintegration prevented, and the formation of dust rendered impossible. This result is obtained by the use of what are known as permanent binders, consisting of the tars and the heavy oils, that is, oils which have been so far subjected to distillation that they contain a large percentage of binding base. The second method seeks merely to keep down the dust that is formed upon the road surface, and therefore is temporary in its action. The temporary binders include certain light oils and tars, oil and tar emulsions, and salt solutions. The temporary binders contain, from their very nature, only a small amount of base, and to effectively keep down the dust, they have to be applied with more or less frequency, according to their richness. It should be noted, however, that each application of the temporary binders leaves, or is liable to leave, a certain amount of its bituminous element permanently in the road, thus producing a cumulative effect, which, in many cases, ultimately gives to the road surface much of the qualities secured by the use of heavy oils and tar.

The principal material used in the permanent treatment of roads with tar are coal tar, refined coal tar, and water gas tar. They may be used effectively, either by applying them to a road already finished, or by incorporating them in the surface material of the road during construction. In applying the tar to an old road, the surface should be thoroughly dry, comparatively warm, and free from dust. Moisture prevents the tar from proper contact with the stone, and a cold surface stiffens the material and prevents its being absorbed. Before the application is made, ruts and hollows should be filled, and the surface brought up to a smooth and even condition. The tar, heated to about 190 deg. F., is spread upon the road through a hose or by other suitable means, and is then thoroughly broomed in. After this has been done, to secure good results, the surface treated should be closed to all traffic for about twelve hours, so as to give the tar an opportunity to thoroughly sink into the surface. Next, a coat of clean sand or stone chips should be applied to absorb any excess tar, and dry up the surface, as it were. The road should then be rolled thoroughly to bring it into condition.

This question of giving the tarred surface a twelve hours' rest involves the difficulty of interference with the traffic. In many cases, the county authorities, after spreading the tar, throw over it a top dressing and permit traffic to make immediate use of the road. This not only prevents the tar from thoroughly impregnating the road surface, but it results in an immense amount of inconvenience and unsightly disfigurement to automobiles and other swiftly moving vehicles. The best way out of the difficulty is to treat one-half of the roadway at a time, reserving the other half for traffic. Even where a road is so narrow that traffic would have to be slowed down to a walk, the users would willingly submit to this lesser inconvenience in order to avoid the discomfort resulting from present methods. In cases where it is impossible to close one-half of the roadway, care should be taken to apply sufficient sand or crushed stone to prevent the tar from sticking to the wheels of vehicles; but this, it must not be forgotten, will spoil somewhat the quality of the bond secured on the road surface.

In applying the tar in new construction, the road should be formed and consolidated without the use of water. The voids should be filled with fine stone chips free from dust, and care must be taken not to roll the surface too heavily, or the tar will not adhere properly. Hot tar may be applied through all of the courses as they are laid and rolled; but occasionally the upper course only is so treated. After tarring, a top dressing of material is laid on and the surface is thoroughly rolled. The tar spreading may be done either by hand, in which case an excess above what is necessary will probably be used, or it may be spread on by an apparatus mounted on wheels, the tar being discharged under pressure at the road surface by specially designed spraying nozzles.

If the work be properly done, a tarred road, after being open to traffic for a short while, takes on an appearance closely resembling asphalt, being smooth and firm, practically noiseless, and more resilient, than asphalt. It is largely waterproof, practically dustless, and the resistance to traction is less than that of an untreated macadam road.

In the following issue we shall take up the subject of the use of heavy and light oils, and of the various salt solutions and emulsions which are being tried out in experimental work.

It is reported that Baron Marschall von Bieberstein, the German Ambassador, recently called the attention of the Grand Vizier to the fact that the American scheme for the construction of railways in Asia Minor, which secured exclusive mining rights over an area of 80,000 square kilometers of land, infringed the existing mining law, which constituted one of the conditions stipulated by the Powers as a return for their assent to the 3 per cent increase in the import duties made in April, 1907. In consequence of these representations, the American project, which was recently approved by the Council of State, has now been referred for examination to the Ministry of Mines, and it is believed that it has received a serious setback, if it has not been entirely compromised.

ENGINEERING.

If the proposed Hudson River bridge is ever constructed, it certainly will not be built at the proposed site at 179th Street for the preliminary borings for the foundations have been carried to a depth of 180 feet without discovering anything but mud and sand. It is stated that a survey will now be made of a proposed site at 110th Street, which will include borings to determine the nature of the river bottom.

Contractors at Roosevelt Dam, Salt River irrigation project, Arizona, are busy finishing up the great dam and accessory structures. Stored water has been used during the past month to augment the natural flow of the river, and about 76,000 acres of land have been supplied with irrigation water. Two of the pumping plants have been in operation on the Gila Indian Reservation, and a third is nearly ready for use. The Indians are preparing to plant over a thousand acres of corn upon the lands to be supplied from these wells.

There was recently opened for traffic at Auckland, New Zealand, a reinforced concrete bridge which contains the largest masonry arch in existence. The structure, which was built by the Ferro Concrete Company of Australia, consists of nine approach spans of from 43 to 81 feet, and a great central arch of 320 feet. The latter is hinged at the abutments and at the center. It consists of two separate ribs, connected by cross struts, with a floor resting on slender columns built up from the ribs. Provision is made for a 24-foot roadway, and two 6-foot sidewalks.

Our publication of the Herrick rotary engine and discussion of her construction and performance has brought illustrations of several interesting types to this office, among which is a double rotary engine, in which steam is cut off in each engine separately and both engines are simultaneously reversed. The engine consists of a casting comprising three parallel bores and rotors, the central bore having a rotary valve pocket, and the two outside bores containing the steam rotors. A fourth bore directly above the center or valve bore carries a hollow reversing valve.

In view of the fact that critics of the proposed method of building the Gatun dam by the use of suction dredges claimed that the material could never be transported and lifted through the necessary distances and heights, it is gratifying to note the excellent work now being done in prosecuting this work. The 20-inch suction dredge, known as No. 83, lifted from one of the old channels and deposited in position during the month of June no less than 197,000 cubic yards. This material was all transported through a distance of from 1,700 to 2,000 feet, with an unaided lift of 25 feet.

The record of work done on the New York State Barge Canal during the past year shows how marked is the progress which is now being made on this great undertaking. During the twelve months, approximately as much construction work was done as in all the four years preceding. The report shows that 121 miles of contracts was let, which is about as much as was let during the first three years of work; about twice as much as was let in any previous year, and is 38 per cent of all the work awarded to the close of the year. In money value, these contracts represent between $18,000,000 and $19,000,000.

One of the most important innovations in the construction of track in this country is the substitution of the screw spike for the old and altogether inefficient straight railroad spike. Many miles of experimental track have been laid, and it is to be hoped that they have been so put down and will be so maintained that reliable results will be forthcoming. A most important question is that of the proper size of hole that should be bored before screwing in the spikes. Experiments in Germany with 0.65-inch screw spikes have shown that the holding power in pounds, in beech ties, varied from 11,350 pounds in a 0.47-inch hole to 11,880 pounds in a 0.65-inch hole, with a maximum of 12,580 pounds in a 0.59-inch hole.

Although the necessary funds are not at present available, the study by Dock Commissioner Tompkins for a railway along the Hudson River docks on Manhattan and contiguous freight warehouses will prove of great value, when this question becomes of such pressing importance as to demand immediate solution. The proposal is for a $100,000,000 municipal joint railway and freight terminal, and the construction of an elevated line on the west side water front of Manhattan, thereby eliminating the New York Central surface tracks. Connection is to be made with large 12-story terminal buildings, to be erected between Twenty-fifth and Thirtieth Streets, and between Thirty-eighth and Fortieth streets. The terminal freight yard is to be an extensive double-deck structure, bounded by West Houston and Spring streets, Washington and West streets.

AERONAUTICS.

A Japanese delegation sent to Europe to investigate the subject of flying machines, recently visited the works of the German Wright Company. The Japanese officers were taken up in Wright machines, and some of the mysteries of plane warping were explained to them. The result of the visit has been the ordering of a Wright machine, which will be delivered in August.

Both Johnstone and Hoxsey made night flights at Asbury Park on August 19th. It was curious to see their Wright biplane, patterned for brief seconds against the brightness of a full moon, or fitting mysteriously in the mellow light across the Milky Way. Hoxsey claimed to have reached a height of 3,458 feet, but since night estimates are difficult to make accurately his claim must be taken with some reservation.

Those of the thousands who journeyed down to the old Sheepshead Bay racetrack on August 20th to see the opening of the air carnival and departed before the close missed the best thing at the meet. Four aeroplanes went whizzing and whirring all about the course at the same time just before 7 o'clock, and the spectators were lost in wonderment. The machines in the air were guided by Curtiss, Ely, Mars, and McCurdy.

A German aeronaut has devised a system of orientation which will help the German aviator, at least, in finding his way through the air. Each German province is provided with a number and every community is provided with a letter. A guide book to be carried by the aviator contains a list of Provinces and towns similarly designated. Thus if an aviator sees the characters "49 A I" painted upon the roof of a house in Rheinau, he knows immediately where he is by referring to his book. At night these signs are to be illuminated. The system is now actually being installed in Germany.

Mr. Wilbur Wright recently visited Belmont Park to look over the ground selected for the international aviation contest in October. He found the aviation grounds somewhat small, but decided that the 62.1-mile race for the Coupe International d'Aviation could be run within the confines of the track. Messrs. Radley, McArdle, and Graham-White have been selected to represent England in this event. The former will use monoplanes of the Blériot type, while the latter will probably use a biplane. Mr. White is coming to America in time to compete in the Harvard aviation meet at Boston from September 3rd to 13th.

It is safe to assert that shape is a by no means negligible quality in seeking an ideal propeller; but pitch diameter, lightness, area, and smoothness of contour form the chief factors in superiority. In the principles underlying the efficiency of air-propellers, there is no getting away from facts and figures as known, that the lighter the traveling surfaces the greater the diameter and the increasing compound pitch, which is at least equal to the diameter (*vide* Maxim); we have a propeller or tractor whose efficiency and tried worth is unquestionable. For that reason, therefore, one should accept with reserved judgment the claims of some constructors, basing, for example, a thrust of 25 pounds per horse-power with a 7-foot diameter screw, the power at disposal being equivalent only to 1 horse-power, giving at 100 horse-power a theoretical thrust of 2,500 pounds. As such this is grossly misleading, inasmuch that, however effective the screw, the diameter or disk area swept out in rotation or volume of air displaced is inadequate, the thrust per horse-power in practice yielding a bare 5 pounds per horse-power at 100 horse-power. To attain a thrust of 25 pounds per horse-power the area and diameter should be greatly increased.

At the recent aviation meet held in Asbury Park last week the first public test was made of the new Wright biplane built for gusty weather. The machine is very similar to the standard type, practically the only change being in the fact that the horizontal rudder in front is left off. In the place of this, the warpable tail surface serves to control the motion up and down. The advantage of this arrangement is that there is nothing in the forepart of the machine to be caught by sudden puffs of wind. As heretofore constructed, wind striking the front horizontal rudder acted with a powerful leverage on the machine, due to the distance of the rudder in advance of the main planes. No such effect is experienced with the horizontal rudder at the rear of the apparatus. The air that passes through the machine is so cut up by the propellers that there is no opportunity for a sudden puff of wind to reach the rudders at the rear. The forward small vertical planes have been preserved in the new machine and are mounted in the framework of the skids. As the entire work of controlling the aeroplane vertically falls upon the rear horizontal plane, the latter is allowed a greater upward or downward curvature than heretofore. In next week's issue of the SCIENTIFIC AMERICAN a photograph and complete description of this machine will be published.

SCIENCE.

The next meeting of the International Commission for Scientific Aeronautics will be held in 1912, in Vienna.

In the Journal of the Meteorological Society of Japan for June, T. Okada describes his experiments on the use of the Japanese paper called "yoshinogami" as a covering for psychrometer bulbs, in place of the usual muslin. He finds that for the aspiration psychrometer of Assmann, as well as for unventilated psychrometers, the paper gives a greater psychrometric difference than muslin, and is therefore a preferable material.

Beginning July 1st, the meteorological and geophysical work of the Kew Observatory, heretofore carried on under the direction of the National Physical Laboratory, was transferred to the control of the English Meteorological Office, and henceforth Kew will be the central observatory of that office. The work of testing meteorological instruments, for which Kew Observatory has been famous for so many years, will soon be transferred to the National Physical Laboratory, but the familiar "K. O." mark will be retained in connection therewith.

Sir John Moore has published a new edition of his "Meteorology, Practical and Applied." The work has been almost completely rewritten, and is an extremely readable popular presentation of the subject, although marred by a number of minor inaccuracies and loose statements that impair its value to the serious student of meteorology. Its author is a distinguished physician and surgeon, whose pastime is meteorology, and whose new book is one of the very few places to which the non-scientific reader who knows no other language than English may turn for a summary of the latest advances in one of the most fascinating branches of science.

It frequently happens that students of science, especially biology, during their vacations spend time in studying the fauna and flora of the locality where they are visiting. Thus it was that during the spring of 1898 Prof. George C. Embody of Cornell University collected a number of amphipods in a spring-fed pond near the town of Ashland, Virginia, and among these he found a new species to which he has given the name of Eucrangonyx serratus. The description of this new form appears as paper No. 1746 in the Proceedings of the United States National Museum and bears the title of "A new fresh-water amphipod from Virginia, with some notes on its biology." The type has been deposited in the National collections.

According to recent statistics published by the Government, the per capita consumption of sugar in the United States in the fiscal year just ended was 82 pounds. Our sweet tooth now demands more sugar than at any time in the country's history. There was consumed in the twelve months 7,500,000,000 pounds, of which the United States, Hawaii, Porto Rico, and the Philippine Islands each contributed larger quantities than ever before. Foreign countries supplied about 51 per cent of the sugar consumed in this country during the year, the sugar fields of continental United States about 24 per cent, and noncontiguous territories 25 per cent.

The United States Weather Bureau, which has been making regular observations of solar radiation at Washington for some years, is now inaugurating similar work at some of its other stations. Observations have been begun at Madison, Wis., and will soon be undertaken at Lincoln, Nebr.; Santa Fé, N. M., and possibly elsewhere, under the general supervision of Prof. Kimball. Prof. C. F. Marvin has devised a new form of actinometer, known in the Weather Bureau as "the Marvin nickel coil pyrheliometer," which is said to give results about five per cent higher than the Angström instrument now in general use in meteorological observatories. It appears to offer decided advantages over all other thermo-actinometers, because of the ease with which its constants may be determined, its simple construction, and the facility with which it can be read.

The fossil beds of the West that have furnished such wonderful specimens of gigantic animals of former ages, such as, for instance, the diplidocus, replicas of which have recently been placed on exhibition in several of the great European museums, sometimes yield fossils which, if not so large as the great saurian mentioned above, are nevertheless of paramount interest to men of science. During the summer of 1909 the remains of several fossil turtles were collected by members of the United States Geological Survey, and from a study of these Prof. O. P. Hay has been able to describe eight new species of fossil turtles from west of the one hundredth meridian. His paper, which is No. 1747 of the separates of the Proceedings of the United States National Museum, Volume 38, covers **twenty pages** and includes three halftone plates and twenty-three text figures.

THE EFFECT OF TARRED ROADS UPON TREES AND SHRUBS

BY FERNAND HONORÉ

When the first International Road Congress was held in Paris in 1902, M. Forestier, who has charge of the streets of that city, expressed a fear that the tarring of the roads in order to lay the dust would have a deleterious effect upon vegetation. His observations, approved by the German engineers, were met with scepticism by the English and French engineers.

A new Road Congress opened at Brussels on July 30th last, and this time the documents presented by M. Forestier seemed to demonstrate that tarring of the roads, at least in that locality, was essentially deleterious to the trees and shrubs.

The avenue of the Bois de Boulogne is one of the best-known streets in the world. This magnificent avenue, which forms an admirable setting to the stream of the four hundred of Paris upon race days, is almost unique in the world. Its total width is 393.6 feet. The central roadway, 52½ feet wide, which is tarred, is flanked by two 39.3 feet sidewalks, each of which is bordered by bands of turf 101½ feet wide, planted with flowering plants of the most varied character. This avenue, which was primarily known as the Avenue de l'Impératrice, was garnished with a collection of all the trees and shrubs acclimated to the latitude of Paris. This collection, which was almost entirely destroyed at the time of the siege, was planted again after the war. Some trees date back about sixty years, while others are forty years of age. All these, up to a short time ago, had a splendid vegetation. During the last few years, however, a considerable number of trees and shrubs have perished. The leaves, more or less shriveled up, covered with brown and pale white spots, and often torn and tattered, appear to be burned and are stopped in their development. This effect is especially noticeable with the lilacs, currants, and Deutzia, as well as the maples, the chestnut trees, the catalpas, etc.

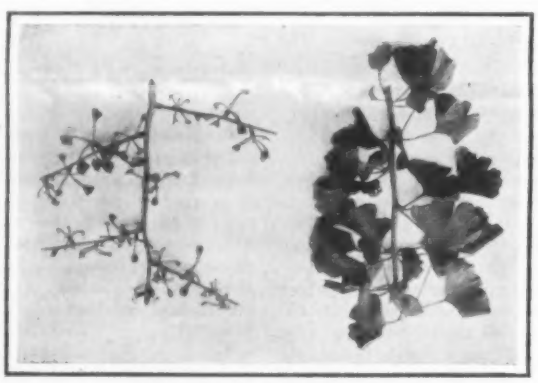
As for the herbaceous plants, such as the geraniums and bergonias, these do not blossom any more. At two different places a clump of stonecrop, which was in perfect condition, dried up the day following the tarring of the road and did not become green again during the season. Our photographs, which are all on the same scale, represent the leaves and branches of the same plants. Those on the right were taken from the Bois de Boulogne not far from the road, or from the neighboring avenues, while those on the left were taken from the vicinity of the tarred road of the Bois de Boulogne.

Although these photographs afford strong presumptive evidence that there is a relation of cause and effect between the tarring of the Bois de Boulogne and the damage to nearby vegetation, the relation cannot be looked upon as fully proved until all the facts are known. Imperfect methods of applying the tar might account for the trouble, although the French, with their long experience in this work, should know how best to do it. As far as we can learn, no such damage to vegetation has been recorded in the United States.

Spirea.

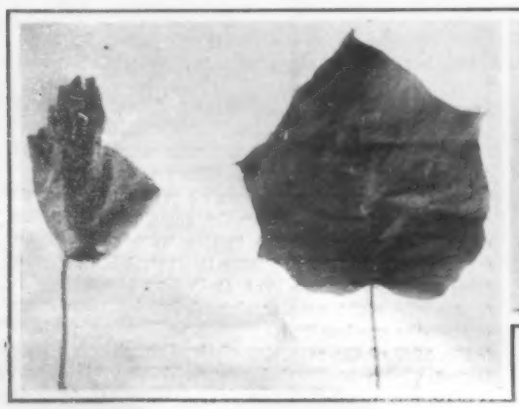
Mock orange.

If any of our readers know of a case or cases similar to this in the Bois de Boulogne, we shall be glad to hear from them.



Ginko or maiden hair tree.

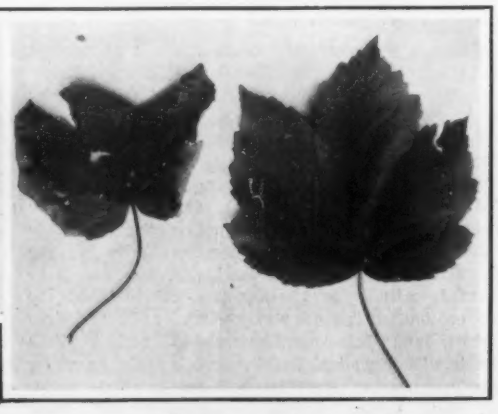
Sycamore maple.



Catalpa.

Horse chestnut.

DESTRUCTION OF VEGETATION ADJOINING THE TARRED ROADWAY OF THE BOIS DE BOULOGNE.



Sycamore maple.

A Great Chinese Encyclopedia.

Interesting experiments are being made at Washington with a view to securing practical use of the 5,000-volume Chinese encyclopedia presented to the United States by the Chinese government in December, 1908.

The encyclopedia has been consulted by nearly a score of Chinese students, resident Chinamen, and American students of Oriental languages, but the 200-year-old characters in which it is written have made adequate translation impossible in this country.

The Bureau of Plant Industry of the Department of Agriculture has finally adopted the plan of photographing pages of the encyclopedia in the Congressional Library at Washington, sending these photographs to China for translation, and then studying the translations when they are returned to Washington. This work has been under the direction of Walter T. Swingle and David Fairchild.

The results have been important to the success of American agricultural and horticultural explorations in China. The meager information upon which the American explorers have worked in their search for new plants throughout the Chinese empire has been greatly augmented from the 32,000 pages given to botanical subjects in the great encyclopedia.

Hundreds of plates have been photographed for translation, covering the subjects of wild rice, alfalfa, clover, date palms and other grains, grasses and fruits. The translations have been secured with great difficulty, even in China, and at the present time the department confronts another delay because of the death of Stephen P. Barchet, interpreter at the American consulate at Shanghai, under whom the work was being done. Many new species, their habitat and characteristics, have been disclosed through the research thus far made. The information is sent again to China from the Department of Agriculture at Washington, in the form of specific notes to the explorers in the field, and has served to put the American explorers on the track of discoveries of importance to American agricultural development. At the time of its compilation, in 1726, hundreds of Chinese students and scholars worked upon the gathering of all existing knowledge for the big encyclopedia that now defies the efforts of translators. Agricultural and botanical subjects were covered with a thoroughness such as has not been achieved in later Chinese works, and the Agricultural Department hopes ultimately to secure access to most of this information by means of translation. The Chinese encyclopedia is considered one of the most important acquisitions of recent years by the Congressional Library authorities. Its 5,000 volumes constitute a mass of learning that may well be measured by the foot and pound. The exhibition case in the library contains 43 of the boxes in which the Chinese preserve the volumes for library references, and more than 500 such boxes are stored in the library vaults.

A blast of great magnitude was recently fired at a quarry near Steelton, Pa., the rock from which is used by the Pennsylvania Steel Co. for flux in its blast furnaces. Thirteen 6-inch holes were drilled 125 feet deep, and reached below the ground level at the foot of the cliff. The holes were 25 feet back from the face of the cliff and about 20 feet apart, the line of them thus extending about 250 feet. In each of the holes were put eighteen or nineteen 50-pound cases of explosive, and above this charge, or more than half the depth of the hole, earth was tamped in hard. It is estimated that 70,000 tons of rock were liberated by the blast, and that the supply so obtained will last the company for months.

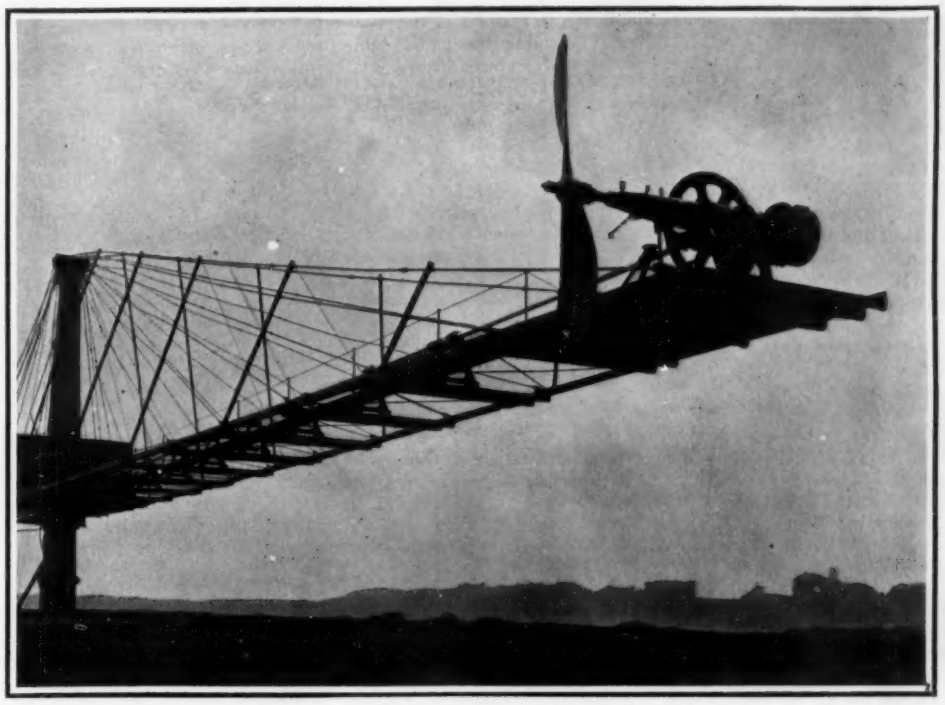
A HUGE PROPELLER TESTING-PLANT

WHIRLING TABLE EXPERIMENTS FOR THE NEW BRITISH DIRIGIBLE

With a view to placing themselves in a thoroughly sound position for coping with future airship orders, Messrs. Vickers Sons & Maxim, the famous naval constructors of Barrow-in-Furness, have just installed near their works a huge whirling table. This firm has the construction of a rigid dirigible for the British Navy at present in hand. Beyond the fact that this huge vessel will be somewhat after the Zeppelin type little is known about it. It is certainly going to be a big one, and it is thought that 400 horsepower at least will be used for driving it. Propellers on a vessel of this size and power run to very big dimensions. And inasmuch as designers work very much in the dark when planning big aerial propellers, Messrs. Vickers Sons & Maxim, with characteristic thoroughness, have decided to collect reliable data bearing upon propeller design.

It is obvious that the only correct method for testing propellers is to measure their thrust while they are moving forward through the air. To enable this to be done the Vickers firm has built a steel tower from which is suspended a big cantilever. The arm on which the propeller is mounted is 110 feet in length, and is balanced by an arm 56 feet long, carrying a water ballast tank at its outer end. Both arms are built up of steel angles and are tied by steel rods to a bracket at the top of the tubular tower. At the head is a ball-bearing supporting the entire weight of the moving part of the structure, while a guide for the bottom end is supplied with four horizontal rollers carried on cast-iron brackets bolted to the lower end of the steel tube and rolling on a turned track on the collar.

For the motive power there is an engine of 100 horse-power situated in a cabin built round the tower on the revolving arms. A line of shafting carries the power to the extremity of the propeller testing arm and drives the propeller through bevel gearing. The propeller is mounted on a sliding shaft which works against a spring thrust abutment. To reproduce actual working conditions more thoroughly a car is rigged up, and resistance planes can be put upon the arm to vary the speed at which the arm rotates. The motion of the arm is due entirely to the propeller thrust, and this thrust can be measured accurately to within one per cent, a special device being introduced to compensate the circular flight

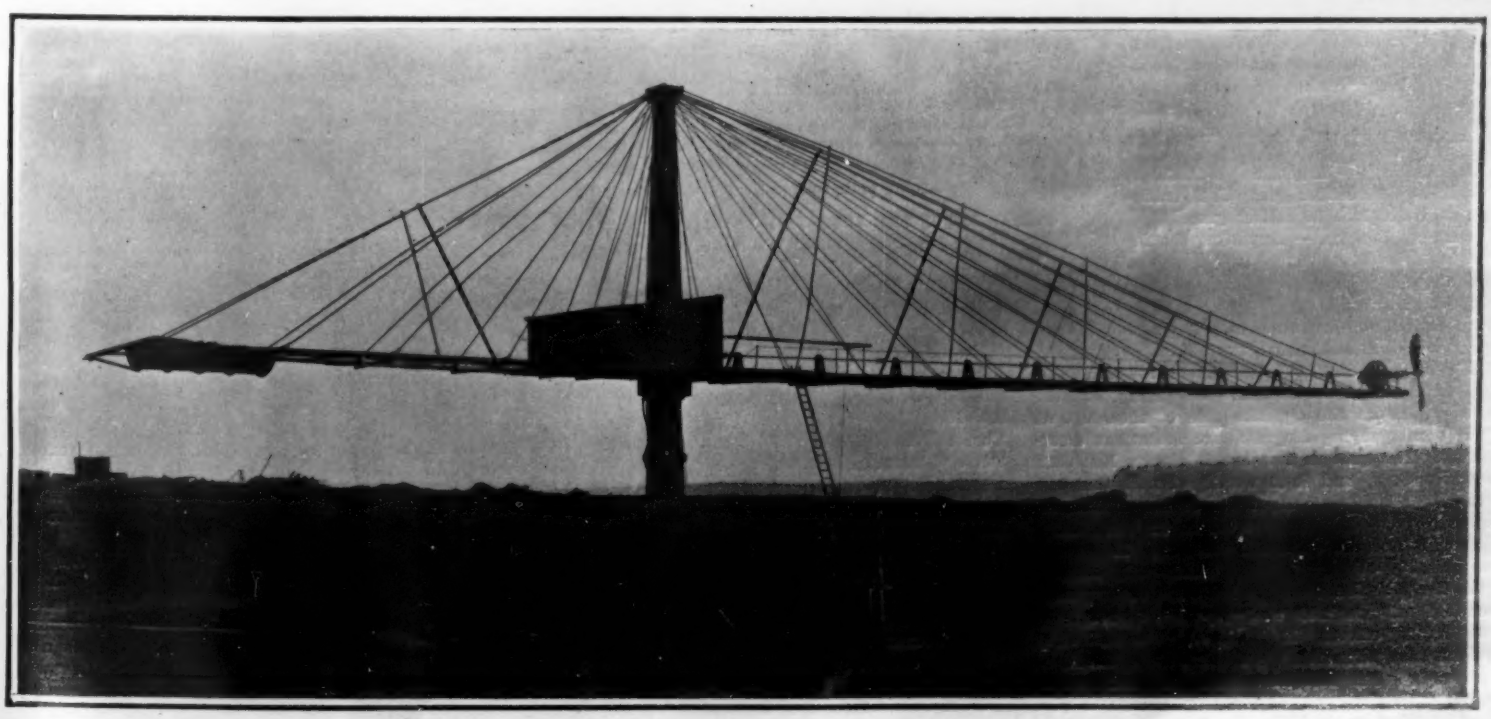


The propeller end of the whirling table.

half. Although one of the immediate reasons for the erection of this monster propeller testing plant has been the trials of the big screws for the new Navy dirigible, the famous firm has decided to apply it also for the testing of propellers by other people. Just at present there is only one small airship in Great Britain besides the Army dirigibles, so the national advantage of this plant will not be great for some time to come. The Army authorities, however, will be able to derive benefit from it, as at present they have nothing of the same kind. If anything of the same nature has been built in any other country it has hitherto been kept in the dark, and, failing other information, credit must be given to Messrs. Vickers Sons & Maxim for the boldness they have shown in tackling this problem on such a big scale.

There has been an increasing amount of interest shown of late in electrical bleaching, and the reports of manufacturers of the apparatus show that there is a steadily increasing demand in existence. Practically the whole of the apparatus sold is used on the Continent, English bleachers, etc., still looking upon the electrical process with suspicion and mistrust; but the introduction of the apparatus into English factories and mills can, of course, only be a question of time, and that time is probably not very remote. According to the Electrical Review, there are various forms of electrolyzers on the market, all operating on the same principle, but differing in details of construction; the detail which presents the most difficulty in designing the cells is the electrode. The substance most generally employed is carbon, which has the advantage over other possible materials that it is cheaper in the first instance. That, however, is all that can be said for it. In one of the best known electrolyzers platinum-iridium is employed. The electrodes in this apparatus are constructed in the form of a fine wire net, so that a minimum amount of the metal is made to cover a large area. Of course, these electrodes are somewhat more expensive than those of carbon in first cost, but they last practically forever and do not depreciate in value. As to the working costs of the electrical process, these depend principally upon the cost of the energy, and with electricity at anything less than ½d. per unit the electrical bleach is cheaper than bleaching powder.

Several readjustments of the personnel of the Weather Bureau have resulted from recent deaths and resignations in the scientific staff, including the appointment of Mr. P. C. Day as the head of the Climatological Division, and Mr. E. H. Dowie of the Forecast Division.



THE VICKERS-MAXIM WHIRLING TABLE FOR CONDUCTING PROPELLER TESTS.

Comparison of the Argentine Battleship "Rivadavia" with the "Wyoming"

TON FOR TON, THE 27,243-TON "WYOMING" IS THE EQUAL OF THE 30,200-TON "RIVADAVIA"

That an American shipbuilding firm should have secured the contract for two Argentine battleships, in competition with the leading builders of Great Britain and Continental Europe, is one of the most gratifying achievements in the history of naval shipbuilding in this country, and the successful bidders, the Fore River Shipbuilding Company, are to be congratulated on their success.

The designs of the "Rivadavia" and "Moreno," as shown on our front page engraving, are excellent, and with the exception of the vessel now building at Armstrong's for Brazil, which will carry the 14-inch guns, they are the most powerful vessels now under construction.

Our esteemed contemporary, *The Navy*, however, in comparing these vessels with our own "Wyoming," claims too much. That publication in a recent issue gives a description, translated from *La Nacion*, of the Argentine battleships, with data revised and corrected to June 2, 1910, and a tabular comparison between these ships and the "Wyoming" class, on which it comments editorially, stating that "The superiority of the Argentine ships appears to extend to practically every detail." The points of superiority cited are as follows: (a) Shorter time of construction; (b) greater all round volume of fire; (c) better protection; (d) two knots more speed; (e) substantially greater radius of action; (f) better fire control; (g) less cost.

Before taking up these points in detail we draw attention to the fact that to render a comparison of two warship designs of any value it must be made upon the same basis. The most important element is that of displacement. Displacement is the naval designer's capital, and a thousand tons advantage in favor of one of two ships will, or should, insure (so well are the principles of design understood) the superiority of that vessel. In the following comparison the Argentine and American vessels are supposed to be fully loaded, in which condition the "Rivadavia" displaces 30,200 tons and the "Wyoming" 27,243 tons. The Argentine vessel, then, at the very outset, has an advantage of about 3,000 tons, and therefore, she should, on every point of comparison, present a decided superiority.

Taking the items in order: (a) Shorter Time of Construction.—The Argentine battleships were contracted to be delivered in twenty-four and twenty-seven months, respectively, against thirty-two months guaranteed in United States contracts.

Progress reports on the "Utah" (a thirty-two month contract) show that she will be completed six months ahead of her contract time, if changes in contract plans so often urged by seagoing officers during the course of construction of a vessel do not interfere.

(b) Greater All-Round Volume of Fire.—This is the question of end-on *vs.* broadside fire, and of centerline *vs.* echelon waist turrets.

The batteries of the vessels compare as follows:

Main Battery. — Argentine battleships, twelve 12-inch 50 caliber guns; U. S. battleships, twelve 12-inch 50 caliber guns.

Secondary Battery. — Argentine battleships, twelve 6-inch and twelve 4-inch rapid fire guns; U. S. battleships, twenty-one 5-inch rapid fire guns.

Torpedo Tubes.—Argentine battleships, two 21-inch submerged; U. S. battleships, two 21-inch submerged.

The echelon or diagonal arrangement of waist turrets has always been attractive on paper; but the angles of fire on the opposite side of the ship, as in the accompanying diagram, are somewhat disappointing. The gain in bow fire is always less than the plans show; and it is worthy of note that one of the most confirmed exponents of the echelon arrangement (England) is reported in its latest ships to have adopted the centerline grouping. The centerline grouping of turrets was unanimously adopted by the Newport Conference in 1908, and this arrangement has only recently received additional support from seagoing officers. It should be noted that eight guns on the "Rivadavia" can concentrate ahead or astern only when the waist guns are fired exactly parallel with the keel. If the ship swings to port or starboard over so little, the forward superstructure cuts out the two guns in either waist turret.

In this connection, as affecting the handling of the battery, a comparison of the gun heights and of the freeboards of the ships is pertinent. In the comparison given in *The Navy*, the freeboards and gun heights appear to be measured in each case from the trial load water line, which is misleading, as the trial displacement of the Argentine battleships contemplates a smaller proportion of the total fuel, ammunition and stores, than in the case of the United States battleships. The change in draft of the Argentine ships from normal to full load is about 30 inches, and of the United States vessels approximately 13½ inches. Referring the gun heights and freeboards to the *full load mean drafts* as a more accurate basis of comparison, we calculate the respective freeboards and gun heights to be as follows:

	—Argentine—		—United States—	
Freeboards.	Ft.	In.	Ft.	In.
Forecastle	23	0	23	10
Midships	20	2	19	2
Aft	14	7	16	3
Turret No. 1.....	29	2	28	3
Turret No. 2.....	37	2	36	3
Turret No. 3.....	29	2	32	11
Turret No. 4.....	29	2	24	11
Turret No. 5.....	29	2	31	3
Turret No. 6.....	19	11	23	3

There is thus an average advantage for the "Wyoming" of 6 inches in freeboard and over 6 inches in height of guns.

(c) Better Protection.—In this statement, *The Navy* is decidedly in error, as the following will show:

Main Belt: Argentine Battleships—8 feet 1 inch wide, 12 inches thick at top, tapered in about 2 feet to 5 inches at the bottom, reaching 3 feet 4 inches below normal waterline, extending over the machinery spaces and waist turrets and magazines, about 240 feet; beyond these at each end, reduced to 10 inches, tapered to 5 inches at bottom, about 76 feet aft and 84 feet forward in way of the forward and after magazines; at ends, 5 inches thick forward and 4 inches thick aft. *The Navy* states this 5-inch armor as 6-inch armor, but the above is according to our own information.

United States Battleships—Main belt, about 8 feet wide; thickness, 11 inches at top, tapered to 9 inches at bottom, covers all turrets and magazines for a length of over 400 feet, and reaches fully 6 feet below normal waterline. Abaft this belt the armor is 5 inches thick.

Upper Belts: Argentine Battleships—Thickness, 9 inches at lower edge, tapering to 8 inches at the top, approximately same height as United States gun deck, extending full length of heavy part of main belt, *i. e.*, about 400 feet.

United States Battleships—11 inches at bottom, tapering to 9 inches at the gun deck, extending full length of the heavy main belt.

Casemate: Argentine Battleships—6 inches thick.

United States Battleships—6½ inches thick, backed up by splinter bulkhead on each side 1½ inch thick.

Smoke Stacks: Argentine Battleships—1½ inch nickel steel to 15 feet above the upper deck.

United States Battleships—Are protected up to main deck by 6½ inch armor and 1½ inch splinter bulkheads.

Protective Decks: Argentine Battleships—Two; upper, 1½ inches; lower, 3 inches.

United States Battleships—Two; over magazines; one elsewhere. We are unable to give the thickness, but it will be proportionate to the heavy protection which characterizes the whole design.

Turrets: Argentine Battleships—Front, 12 inches; sides, 9 inches; back, 11 inches; top, 3 inches.

United States Battleships—Thickness not available, but believed to be substantially identical with Argentine, except as to roofs, which are heavier.

Barbettes: Argentine Battleships — 9 inches.

United States Battleships—11 inches.

A most important and vital difference, as the barbettes protect all the turret supports and loading arrangements.

Under Water Protection: Argentine Battleships—1 inch nickel steel bulkhead extending throughout the magazine and machinery spaces, and ¾-inch nickel steel flats beneath the magazines and machinery spaces.

United States Battleships—We believe that about 1½ inches longitudinal special treatment steel bulkhead is to be used in way of magazines. There is, in addition, a watertight longitudinal bulkhead covering the extent of the magazines and machinery spaces which does not exist on the Argentine ships.

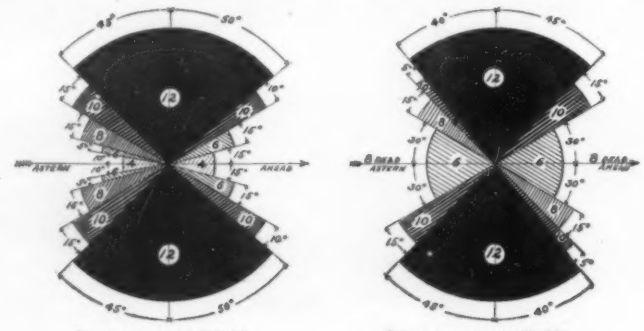
Conning Towers: Argentine Battleships—Two; forward, 12 inches; aft, 9 inches.

United States Battleships—One; substantially identical in thickness with forward conning tower of Argentine ship.

It will be seen that the main belt armor on the Argentine ships is slightly thicker at the upper edge than that on the United States battleships, but only for about 240 feet amidships; the lower edge of this same armor is, however, thinner than that carried on the United States vessels; the upper belt and casemate armor is thicker on the United States vessels than on the Argentine battleships. While the turrets are substantially identical, the United States barbettes are 2 inches thicker than those of the Argentine.

(d) More Speed.—Argentine battleships are to be 22½ knots on trial.

United States battleships are to be 20½ knots, but the speed of the former when fully loaded will be reduced to a greater extent than that of the latter, owing to the much greater change in displacement between normal and full load condition. It is also obvious from the horse-power of the machinery of the two vessels that the American has a substantial margin of speed, and will probably overrun its designed speed from one-half knot to a full knot, where-



Latest American battleship. Latest Argentine battleship.

Density of fire, over all arcs of train, from main batteries of latest American and Argentine battleships.

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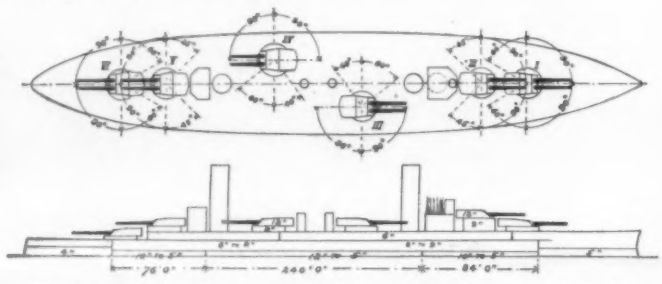
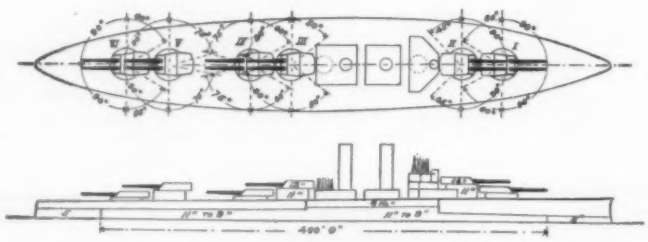


Main belt: Length, 400 feet; width, 8 feet 1 inch; depth below normal water line, 8 feet 4 inches; thickness at top, 12 inches to 10 inches; thickness at bottom, 5 inches, tapering in last two feet. **Upper belt:** Length, 400 feet, reaches from main belt to gun deck; thickness at bottom, 9 inches, at top 8 inches. **Casemate armor,** 6 inches. **Turrets,** 12 inches to 9 inches. **Barbettes,** 9 inches.

Armor plan Argentine "Rivadavia."



Main belt: Length, 400 feet; width, about 8 feet; depth below normal water line, about 6 feet; thickness at top, 11 inches; thickness at bottom, 9 inches. **Upper belt:** Length, 400 feet, reaches from main belt to gun deck; thickness at bottom, 11 inches; at top, 9 inches. **Casemate armor,** 6½ inches plus 1½ inch splinter bulkhead. **Turrets,** 12 inches to 9 inches. **Barbettes,** 11 inches.

Armor plan United States "Wyoming."

COMPARISON OF THE ARGENTINE BATTLESHIP "RIVADAVIA" AND THE "WYOMING."

as the Argentine vessel will, with the accredited horse-power, probably do no more than meet the speed requirement.

The Argentine ships, although drawing a foot less in normal condition than the United States vessels, draw about 4½ inches more when fully loaded.

(e) GREATER RADIUS OF ACTION.—The cruising radius of the Argentine battleships is to be 10,000 knots, at 11 knots speed on coal only, while that of the United States battleships will probably be over 8,000 knots on coal and oil, at a speed of 10 knots. This difference is obtained by the coal capacity of 4,000 tons on the former, as against 2,500 tons on the latter, and an oil capacity of 660 tons as against 400 tons. The advantage of nearly 3,000 tons greater displacement possessed by the Argentine ship has been applied mainly to the stowage of this large excess of fuel and to more powerful boilers and engines.

(f) FIRE CONTROL.—This is a matter of opinion. As a matter of fact, the arrangements on the United States ships were designed to suit the needs of the service as expressed in detail by our seagoing officers, and it is to be assumed they fulfill the requirements of the case. Experience has shown that it is difficult to accurately "spot" the falling shells from positions of moderate height.

(g) COST.—Argentine Battleships—Complete, fully equipped for delivery, $10,665,300:

United States Battleships—The figure given in *The Navy* is $11,500,000, estimated. On this figure their criticism is based. This cost is possibly taken from an estimated cost given in the testimony of the Secretary of the Navy before Congress. This figure was doubtless based, as is the custom in such cases, on the legal limit of cost for hull and machinery of $6,000,000. Taking the actual contract price for hull and machinery for the "Wyoming," $4,450,000, and for the "Arkansas," $4,675,000, this total cost would reduce to $10,006,220 for the "Wyoming, or $10,231,220 for the "Arkansas," as compared with the figure given for the Argentine ships.

In brief, *reducing both ships to their full load displacements, as these are directly comparable*, we find the "Wyoming" class to be 27,243, and the "Rivadavia," 30,200 tons, and comparing the two ships on this common basis, it is seen that the United States ship has, on 2,957 tons less displacement, better armor protection, equal battery, equal or greater freeboard, less speed on trial, less radius of action. In other words, for greater displacement and cost, the Argentines obtain greater speed and greater radius of action, but considerably less protection, other qualities being approximately equal.

It is worthy of note that the "Wyoming's" plans were passed upon and commended by the seagoing officers of our navy.

American Homes and Gardens.

During the past twenty years, in traveling throughout the country, the editor of American Homes and Gardens has had an opportunity to observe the rapid progress which has been made in the embellishment of the home grounds and the garden about the house. It may be fair to say that the progress which has been made in this direction in the past two decades is largely due to the force and amount of criticism that have been brought to bear by magazines of the class of American Homes and Gardens, which literature has been the means of checking the rivalry between the house and the garden, until each has been recognized as equally necessary in the maintenance of the equipoise of improved suburban property, small or expensive, modestly or pretentiously treated.

An all-around look over the horizon of gardens throughout the country shows that an effort to obtain a better development of the house plot has been stimulated by the prize garden competition which closed September 15th, 1909, and which formed the subject of a series of interesting and instructive articles appearing in our columns durihg the past year. The donors were so much impressed with the wide interest manifested by our readers in the series that they have decided to institute another Garden Competition for 1910, and to offer a prize of $100 for the four best planned and developed suburban and village gardens, the sole object of which is to further a love for gardening in America, particularly in suburbs and villages, and we want our readers to help us so that we can assist others to beautify their surroundings. There are many people who would like to improve their garden conditions, but are unable to do so from the lack of knowledge, and this is the reason we ask your co-operation and your assistance. It makes no difference whether your garden be naturalesque or formal, English, Japanese, French or Italian, a rock garden or a rose garden, it will be judged solely on its merit as the successful presentation of a particular arrangement of results.

If you have an attractive garden, send in one or more photographs with a plan or a description of it. Make a rough sketch of the garden, showing the position of the plants and their relative arrangement to one another. Tell the story of the garden's success in your own way. Where it is found difficult, even by one who has the garden habit, to present in the text the full floral beauty of design and reach of culture displayed in his acre or any part of it, he has the art of photography to render outline, tone and body nearly as well as it would be perceived if one were upon the spot. So the literary value of the written description or the technical perfection of the plans or photographs will help you only so far as a good presentation of the garden helps the judges to understand the problem and its solution.

The editor feels that there are almost endless possibilities in a small house plot in this country, and that something ought to be done to stimulate the suburban house-owner to embellish what little land he may have, and add not only beauty to his own possession, but a charm to the whole general surroundings of the place in which he lives. He apprehends that despite the fact that our gardens are sufficiently ornamental in themselves, they are isolated and bear no general relation to each other as do the gardens of Europe. England, for example, may be considered as a single continuous garden. Hence, each possessor of a home should so design his garden as to harmonize with those around him, and we trust that he will not only contribute, but receive valuable suggestions from the forthcoming garden prize competition.

A copy of the conditions for the competition will be furnished upon application to the Garden Competition Editor, American Homes and Gardens, 361 Broadway, New York City, N. Y.

Florence Nightingale.

When she died at the ripe age of 90 years, Florence Nightingale had lived to see the adoption of her hospital methods by most of the world's armies, methods which have undoubtedly brought about a most salutary improvement in the conditions of the wounded on the field of battle, and in the saving of many a useful human life.

Her work dates from the beginning of the famous Crimean War, a conflict which was discreditably mismanaged both from a military and from a medical standpoint. Sir Howard Russell, the correspondent of the London Times, told his fellow-countrymen a story of hospital horrors which shocked the British nation. He told a gruesome story of Englishmen dying, not from Russian bullets, but from disease, in British hospitals. He pictured a ghastly scene of inadequate hospital management, inefficiency, death, squalor, infection and suffering. For weeks men lay in hospitals with their wounds undressed, without proper nourishment, and in conditions so foul that even normal, healthy human beings ultimately suffered. The death rate was 40 per cent at Scutari and 52 per cent at Kuleli. Eighty per cent of those who sustained amputations died of gangrene. During the first stage of this terrible war, not a woman nurse was employed in any of the military hospitals. In one of his letters Russell asked, "Are there no devoted women among us, able and willing to go forth and minister to the sick and suffering soldiers of the East in the hospitals at Scutari? Are none of the daughters of England at this extreme hour of need ready for such mercy work?"

It was Miss Nightingale who answered his call. At the suggestion of the Hon. Sidney Herbert, Minister of War, she began the organization of the hospitals. With forty companions she left London for Scutari. She worked wonders. Totally disregarding military red tape, she reorganized the entire system of military hospital management, brought order out of chaos, reduced the death rate and saved thousands of lives. What is more, she gave us our modern system of hospital management, a service of vastly more importance even than her wonderful achievements during the Crimean War.

After the conflict in Russia was over, her work was fittingly honored at a dinner given by Lord Stratford in London to the officers who had distinguished themselves in the Crimea. When the host rose and asked for an expression of opinion from those present as to who was most deserving of the nation's gratitude, every man present agreed on the name of Florence Nightingale.

When she entered the Crimean War, Miss Nightingale was no novice in nursing. She had worked in the hospitals of London, Edinburgh and Dublin, and passed a period of study at the Lutheran Hospital at Kaiserwarth, near Düsseldorf, under the strict eye of its pastor-founder, Dr. Fleidner. When she returned to her native land, she was by far the leading authority on hospital nursing in Great Britain.

It was her own thorough education that no doubt drove home to her the need of systematic education of nurses. She advocated that need during her whole life. The fund of $250,000, to which all classes eagerly contributed after the Crimean war was over (every soldier in the army giving a day's pay) was immediately used by Miss Nightingale to establish and maintain an institution for the training of nurses and hospital attendants, an institution known as the Nightingale home, attached to St. Thomas's Hospital in London. For many years she personally superintended the school.

America, too, profited by Miss Nightingale's counsel. During the Civil War she gave her advice on camp nursing and camp sanitation, and the United States Sanitary Commission, organized by women, was the fruit of her labors.

Still another of her great works was the inauguration of the Red Cross movement at Geneva in 1863. The Red Cross, which is now to be seen on every battlefield, may well be regarded as a symbol of Florence Nightingale's triumph over the cruel disorder of a previous day.

When she reached her 87th birthday, Miss Nightingale was decorated with the English Order of Merit, which was established by King Edward in 1902, and the membership of which is restricted to twenty-four. She is the only woman upon whom that decoration was ever bestowed, and the statutes of England had to be modified in order that she might receive it.

The Fire at the Belgian Exposition.

The so-called "White City" of the Belgian exposition was swept by fire on August 14th, with the result that a loss of from six million to ten million dollars was entailed. The Belgian and British sections suffered most, but the damage by smoke and water has been general. Fortunately the American section escaped the fire.

The entire Belgian and British sections, the Coney Island of the exposition, and everything west of the Avenue des Nations, were destroyed. The Danish, Russian, Norwegian, Austrian, Chinese, Turkish and Swiss sections were saved practically in their entirety. One-third of the entire French section, as well as the façades of the Italian and Spanish sections, were burned.

Nothing was saved in the Belgian and British sections. The British loss is particularly heavy. It includes many priceless art works, among them Tudor panels from the Toronto Museum, tapestries and furniture from the collections of Bernard Moore, as well as some valuable paintings.

The Esperanto Congress at Washington.

The sixth international congress of Esperanto was held in Washington from August 14th, to August 20th. Almost every civilized nation in the world was represented. Although the delegates came from all quarters of the globe, each speaking a language of his own, yet all were able to understand one another through the medium of Esperanto.

Special Esperanto entertainments were provided. Apart from the serious meetings and discussions there were an elaborate open-air presentation of Shakespeare's "As You Like It," translated into Esperanto for the occasion, and given by the Hickman players; a formal ball, at which the delegates wore their national costumes; an excursion to Washington's home at Mount Vernon; an informal concert and recitations by Esperanto amateurs, etc.

A central dining hall was provided where the delegates had their meals together and conversed in Esperanto. An American League baseball game was also played to initiate the foreigners into its mysteries, a special book of rules in Esperanto having been prepared.

The Current Supplement.

The current SUPPLEMENT 1808 contains an unusual number of interesting illustrated articles. That which opens the paper is entitled "Scherzer Rolling-Lift Bridges," and discusses particularly the rolling-lift bridge of the Buenos Ayres Great Southern Railway Company. Another installment of Sir J. J. Thomson's splendid Royal Institution paper on Light and Electromagnetism is published. An interesting instrument called the "Mico" Reciprocating Meter has been brought out, which measures the total distance traveled by an engine piston, regardless of the number of strokes made. The instrument is described and illustrated. Mr. Gerald Stoney continues his instructive discussion of steam turbines. Mr. B. Fallot tells how vinegar can be made at home. Fish culture practices in the United States Bureau of Fisheries are described by John W. Titcomb. The amount of wood used on the farms of the country, and exposed to rapid decay is enormous, for which reason some effort should be made to preserve it. Some simple methods of treating the farm timbers are described by Mr. C. T. Willis. Mr. E. Weichert's thoughtful paper on "What We Know About the Earth" is concluded.

A safe has been specially constructed for the British Radium Corporation. Experiments made by experts proved that practically the only metal which would resist the radium emanations was lead, and the safe is therefore lined with 3-inch lead.

ECONOMIC VALUE OF WILD BIRDS

BY H. A. CRAFTS

California has just established a State bird farm near Hayward, Alameda County. Its first object is to breed game birds for the stocking of the forests, ranges and covers of the State, for the benefit of sportsmen; but it promises to have other and more far-reaching effects.

The species at first to be propagated consist of pheasants, partridges, bob-whites and wild turkeys, but it is the intention of the State in time to breed song-birds as well.

As the State has an area of more than 153,000 square miles, and the bulk of this area being wild land, it may be plainly seen that the field is very large, and offers great possibilities in the line of bird culture.

Next to the sportsmen, the farmers of the State will become interested in the movement. In the first place it is the intention of the promoters of the scheme to have the game laws amended so as to permit the farmers to raise pheasants and other birds for commercial purposes.

But far and away beyond this interest comes that of a possible conquest of the insect-pest evils that afflict the State. By reason of its mild and equable climate California is a very favorable field for the rapid increase of insect life, and the wild birds being scarce the injurious insects have in the past become a host, and have caused millions of dollars damages to the fruit growers.

And in order to keep these insect pests under anything like reasonable control the State is obliged to maintain one of the most extensive horticultural quarantine departments in the world; to use vast amounts of sprays and fumigants and to maintain a parasitic system that is a wonder of modern industrial history.

Yet, with all the repressive measures employed, the losses from insect-pests are very large annually, and the propagation of wild birds should be hailed by the farmers of the State as a hopeful sign for the future.

Briefly, the bird farm is supported by funds derived from the State treasury, and is under the general supervision of the State Game and Fish Commission. It consists at present of forty-two acres, but will soon be enlarged to one hundred.

The breeding of young birds was begun last year, and it is expected that by another year the farm will be in a position to turn out from 4,000 to 8,000 annually. The young birds will be distributed over the State as evenly as possible, and will be given out to approved applicants, in bunches of fifty to one hundred. No applicant will be given any birds until his reliability has been established and not before he has pledged himself to care for and protect the fledglings previous to becoming established in their new abodes.

The farm has been fitted up with necessary buildings, including superintendent's residence, barn, water tank, etc., besides fifty pens in which to keep the breedings birds.

The pheasants used for breeding purposes were all imported from Europe, and the bird that seems destined to become most popular in the State is the Hungarian pheasant. The wild turkeys used are obtained from Old Mexico and consist of two species, one a small kind, not much larger than a common grouse, and another of the ordinary size.

The breeding females of the various species under care lay their eggs in the pens quite promiscuously, and the eggs are gathered by the keeper and placed under common hens for hatching. Of these hens the farm has a flock of 225, and they are of the white and Barred Plymouth Rock strains.

After hatching, the chicks are allowed to run with their foster mothers for a period of two months. Then they are taken away and placed in pens by themselves until ready to liberate.

Great care has to be exercised in the rearing of these young fowls. At first they are fed on maggots, and the grubs have to be propagated on the farm. They are also fed on milk curds.

Brooders with outside runs are used and the brooders are moved every day in order that strict sanitary rules may be observed. The birds, both young and old, are given fresh water daily, and plenty of it.

But the California climate is very favorable to bird life and it is expected that the work of stocking the State will go rapidly on.

Possibly a few farmers and gardeners will get the idea that so many wild birds will be a menace to their crops, but when the benefits to be derived by the farmers and fruit growers at large, in the way of insect-pest control, are weighed against the possible damage, it will be found that the latter becomes comparatively insignificant.

This truth has been no clearer shown than by a paper read by W. R. McIntosh of Fresno during the session of a recent fruit-growers' convention. Among other things, Mr. McIntosh set forth that:

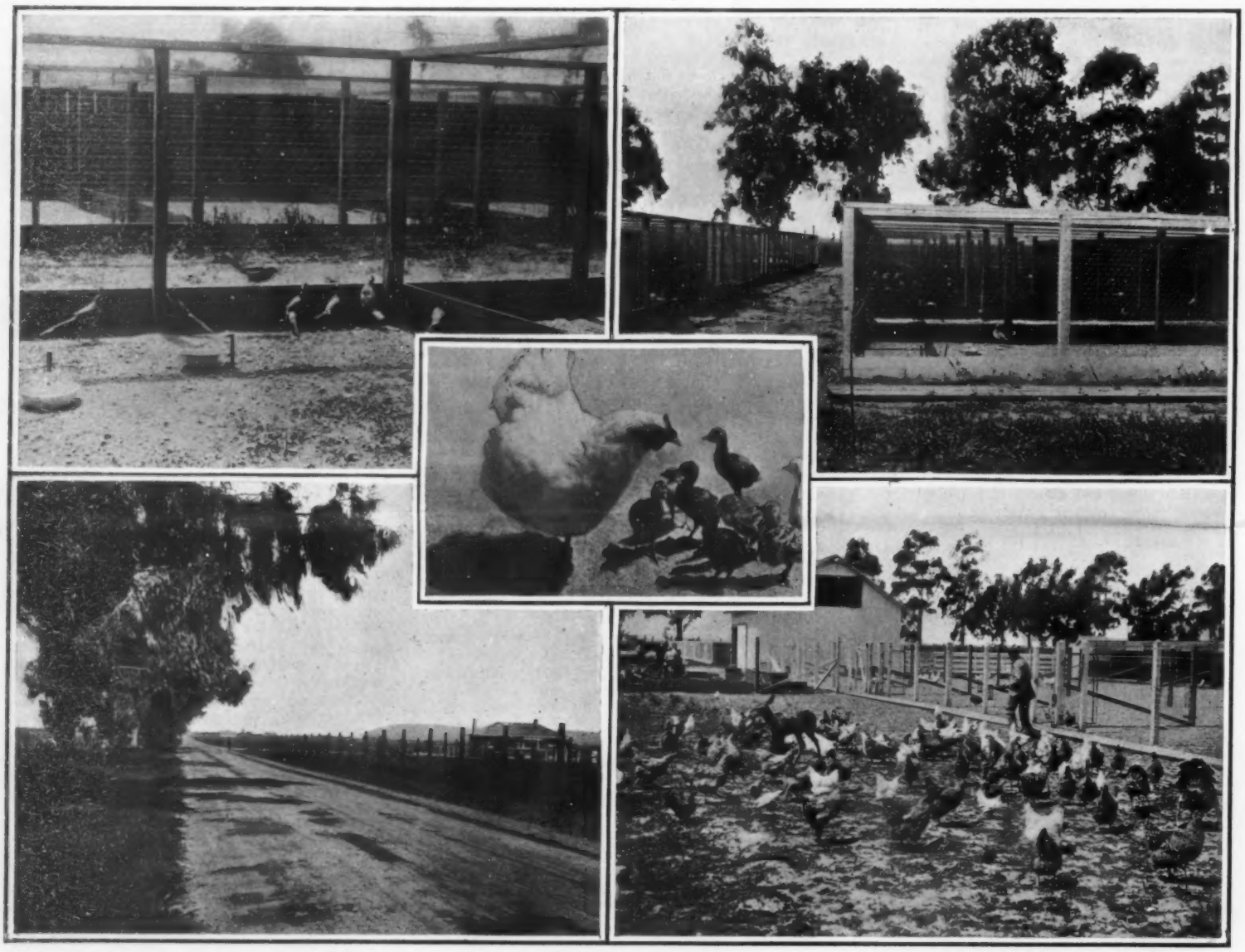
"Nowhere in the material universe do we find a more interesting and beautiful law of balance and harmony than formerly existed in the lives of insects and wild birds. Insects are justly regarded everywhere as the enemies of agriculture. Their destroyers—the birds—must therefore be the farmers' best friends. So long as nature held undisputed sway our friends kept our enemies in check, and small damage resulted to growing crops, and the husbandman was fairly secure in his calling.

"In the destruction of the home of wild birds—the forests—by ax and fire, and the wanton and cruel slaughter of birds in the name of sport, the relations and harmony of nature have been undermined and

(*Concluded on page 168.*)

Group of pheasants in a pen.

View showing arrangement of pheasant pens.



Bird farm on right. Eucalyptus trees on left.

An old hen mothering wild turkeys.

Hens used for hatching game birds.

ECONOMIC VALUE OF WILD BIRDS.

NEW AND SIMPLIFIED PHYSICAL APPARATUS

BY JACQUES BOYER

M. Chassagny, Inspector of the Academy of Paris, in continuing the work of transforming the physical laboratories, of which some description has already been given in the SCIENTIFIC AMERICAN, has introduced a number of ingenious and simplified instruments, which will allow the professors to vary their lecture experiments. The liquid baroscope (Fig. 1) gives a simple demonstration of the fundamental law of hydrostatics: that a body immersed in a fluid is subjected to an upward pressure equal to the weight of fluid displaced. This instrument is composed of a little metal drum, having one face made of sheet India rubber, which is attached to the end of a copper tube that runs parallel to the plane of the India rubber membrane. This tube communicates by means of an India rubber tube with a "U"-shaped glass tube containing colored water. When pressure is exerted upon the rubber membrane by laying a weight upon it, or by immersing the drum in a liquid, the rubber is pressed inward and compresses the air within the drum. The pressure is communicated to the "U" tube and produces a change of level of the colored liquid to an extent proportional to the pressure, which can thus be measured. By means of this apparatus, the pressures in various parts of a liquid can be easily studied and demonstrated.

Another instrument is an electro magnet, the novel feature of which is the facility with which it can be taken apart and adapted to various purposes, as is shown in the illustration (Figs. 2 and 3). Two bars of soft iron, each surrounded by a coil of wire, are connected by a massive base of soft iron, which gives the instrument great stability. To the upper ends of the bars are fitted movable pole pieces, ending in flat surfaces against which a soft iron armature can be

(*Continued on page 168.*)

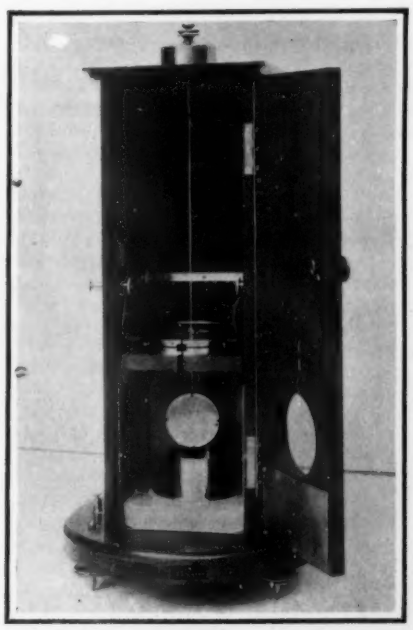
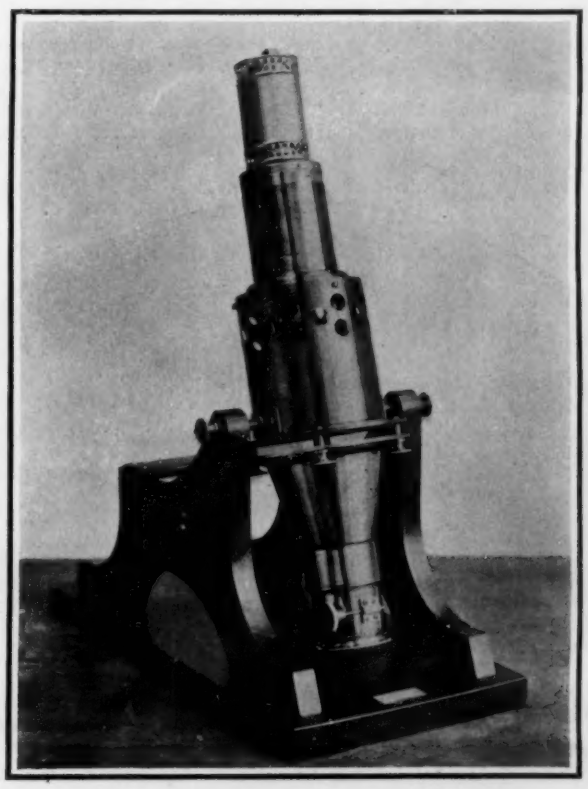


Fig. 4.—Chassagny quadrant electrometer.



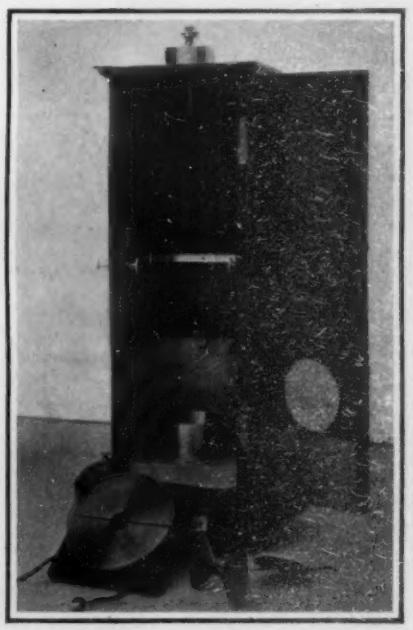


Fig. 5.—The electrometer taken apart.

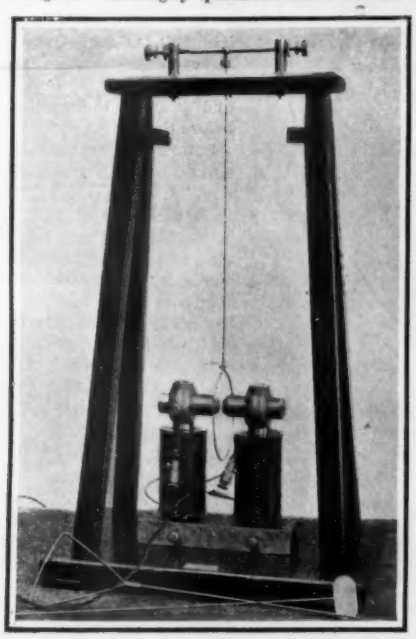


Fig. 2.—Chassagny electromagnet.

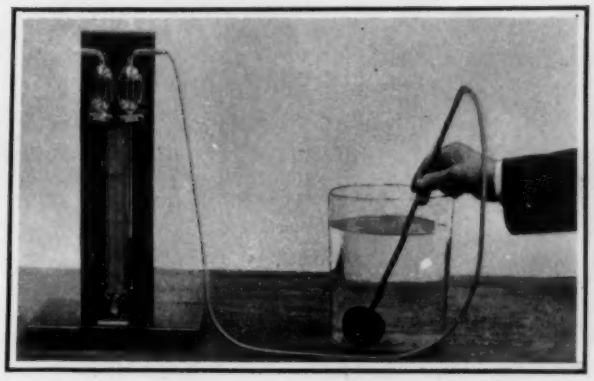


Fig. 1.—Chassagny liquid baroscope.

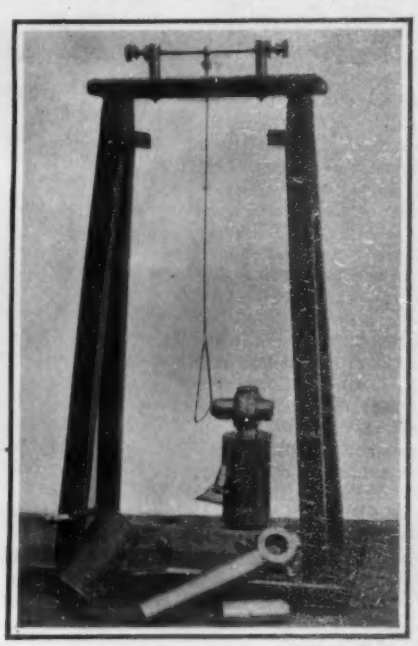


Fig. 3.—The electromagnet taken apart.

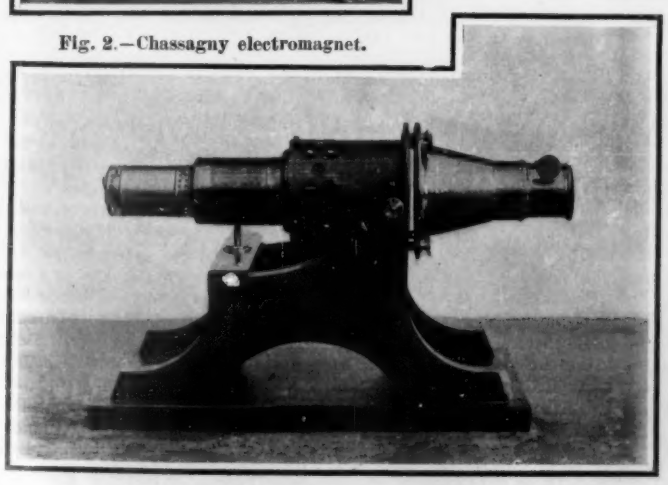


Fig. 7.—Chassagny "cannon" projecting lantern.

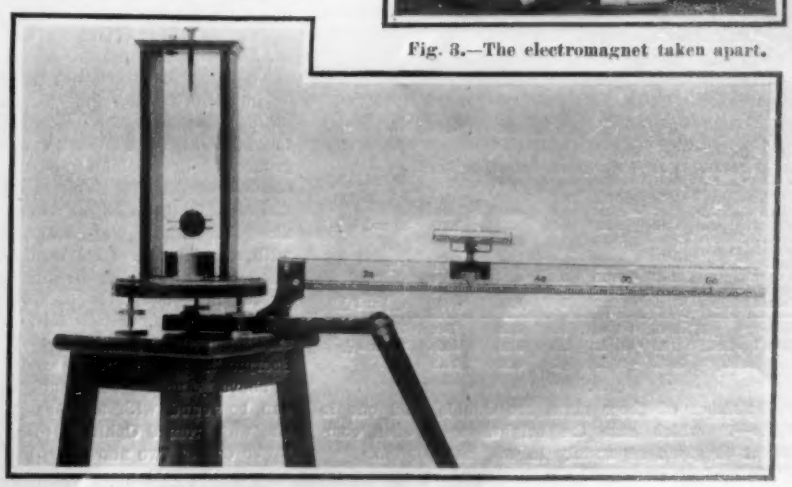


Fig. 6.—Chassagny magnetometer.

NEW AND SIMPLIFIED PHYSICAL APPARATUS.

THE HEAVENS IN SEPTEMBER

BY HENRY NORRIS RUSSELL

AMONG the problems of astronomy in which great advances have been made in the last decade or two is that of measuring the distances of the stars. The principle upon which these are found, using a diameter of the earth's orbit as base-line, is indeed an old one; but the practical problem of making instruments capable of measuring very small changes in the relative position of the stars with sufficient accuracy—formerly an almost insurmountable difficulty—has of late years been satisfactorily solved in a number of quite different ways, and so much work has been done that the number of stars whose parallax has been determined is about seven times as great as it was ten years ago.

A recent summary of these results by Professor Kapteyn — one of the leading authorities on the subject—makes it possible to give a satisfactory answer to the question: Which are the nearest stars? so far as at present is known.

The table which follows gives the principal facts concerning the ten nearest stars, and some other near ones which are visible to the naked eye. First comes the name usually assigned to the star; then its position in the sky—given roughly to help in finding it on a star-map—and its apparent magnitude. (It may be remembered that the brightest stars, except Sirius, are of about the magnitude 0, that the magnitude increases for the fainter stars, and that those below the sixth magnitude — i. e., with *greater* numerical magnitude—are invisible to the naked eye). Then comes the star's parallax—that is, the apparent distance between the earth and sun as seen from the star—always a very small angle; and next its distance in light-years — in other words, the length of time it takes its light to reach us, traveling at the rate of 186,000 miles per *second*, or about six million millions of miles per year, and finally the actual brightness of the star, compared with the sun as a standard.

For most of these stars the data depend on the average result of the work of several observers, and are reliable within ten per cent or less. A few less accurate values, which may be considerably modified by later research, are put in parentheses:

THE NEAREST STARS.

Name.	R. A. h. m.	Dec. ° ′	Magnitude.	Parallax. ″	Distance (Light Years).	Real Brightness (Sun = 1).
α Centauri ...	14 32	−60 25	0.3	0.75	4.3	2.0 and 0.6
Lalande 21,185.	10 58	+36 38	7.4	0.40	8.1	$\frac{1}{170}$
Sirius	6 41	−16 34	−1.6	0.38	8.6	48 and $\frac{1}{3.6}$
82 Ceti	0 32	−25 19	5.7	(0.35)	(9.0)	$(\frac{1}{70}$ and $\frac{1}{25})$
τ Ceti	1 39	−16 28	3.6	0.31	9.7	$\frac{1}{2.6}$
Procyon, ...	7 34	+ 5 29	0.5	0.32	10.0	10 and $(\frac{1}{2.6.0})$
Gould's Zone Catalogue 5h. 263	5 7	−44 59	8.3	0.32	10.1	$\frac{1}{3.1}$x
61 Cygni ...	21 2	+38 15	5.6	0.31	10.4	$\frac{1}{2.6}$ and $\frac{1}{20}$
Lalande 26,481..	14 25	− 15 11	7.9	(0.31)	(10.4)	$(\frac{1}{25})$
36 Ophiuchi....	17 9	−26 27	5.8	(0.30)	(10.6)	$(\frac{1}{4.5}$ and $\frac{1}{2.5})$
Altair ...	19 46	+ 8 36	0.9	0.24	13.6	12
η Cassiopeiæ...	0 43	+57 17	3.6	0.20	16.3	1.4 and $\frac{1}{12}$
ε Draconis.	14 32	+69 29	4.8	0.20	16.5	$\frac{1}{5}$

A number of these stars are double, and one is triple—in which case the brightness of each component is given separately in the last column.

The curious names of the fainter stars arise from the practice of denoting them by their number in some well-known star catalogue (such as Lalande's, published toward the close of the eighteenth century).

It appears from this table that the nearest star next to Alpha Centauri is not Sirius after all, but one quite invisible to the naked eye. Recent observations on this at Yale just published put it a little nearer than was previously supposed, and force Sirius into third place. But the inevitable uncertainty of even the most careful observations is such that we cannot yet be quite sure which is the nearer since their distances differ by only about 1/20 of the whole. There is, however, no doubt at all that one of them looks to us, and really is, about five thousand times as bright as the other—which is a striking illustration of how great the actual range in brightness is among the stars.

Of the ten nearest stars, three—Alpha Centauri, Sirius and Procyon—are apparently among the brightest in the heavens; one more—τ Ceti—is conspicuous to the naked eye; three others are just visible without telescopic aid, and the remaining three require this. It is quite possible that among the faint telescopic stars a few more may be discovered which are equally near us.

THE HEAVENS.

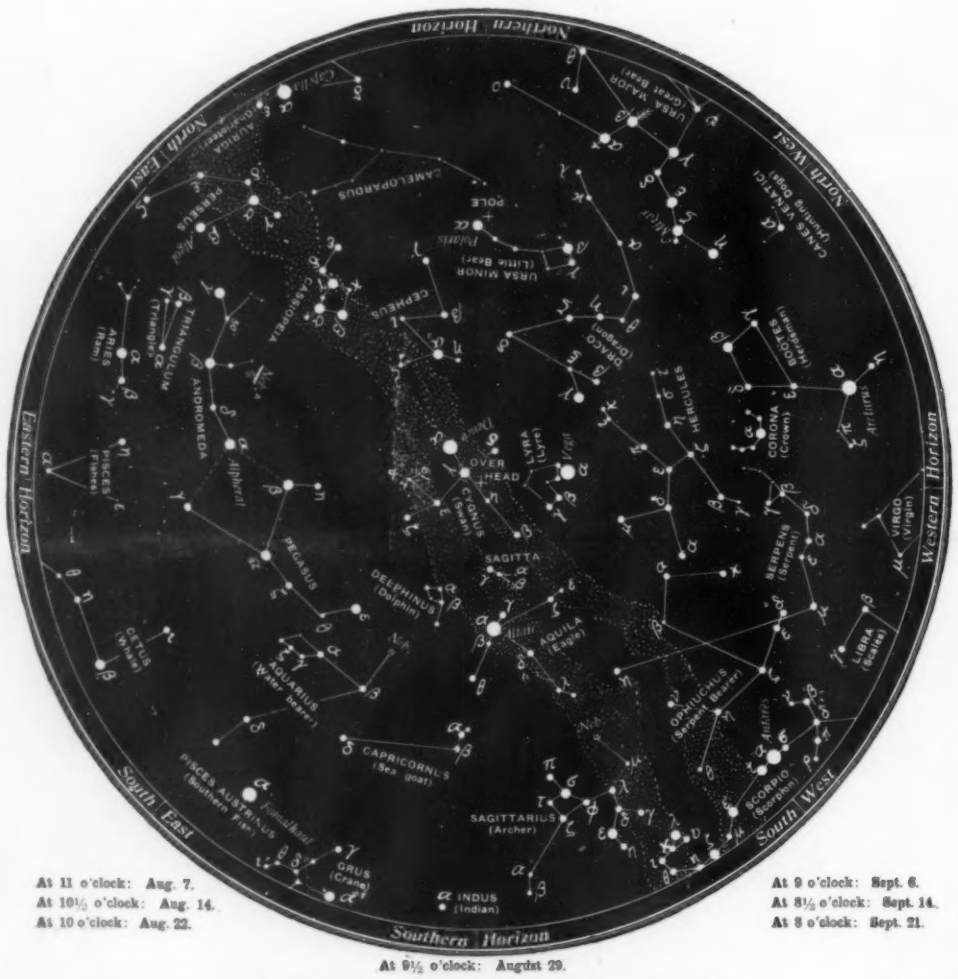
At our usual hour for star-gazing a splendid group of stars is right overhead—the great cross of Cygnus, in the Milky Way, and the smaller group of Lyra to the west, which would be inconspicuous save for the brilliant Vega. On the south beyond the small groups of the Dolphin and the Arrow, is the fine constellation Aquila. Our initial shows how the figure of a flying eagle, its outspread wings stretching along the Milky Way, may be seen in this group with a good deal of aid from imagination. Its principal star, Altair, has already been mentioned as one of our near neighbors in space.

Below Aquila, on the left, is Capricornus, with a pretty naked-eye double, and, on the right, Sagittarius. Scorpio is setting in the southwest, and Ophiuchus is above. Another of our neighbor stars, 36 Ophiuchi, can be found with a field glass about two-fifths of the way from θ Ophiuchi toward Antares. It is the lower one of two stars just visible to the naked eye, and in the field glass shows as a wide double. The two stars, though nearly a quarter of a degree apart, are moving together in the sky, and are doubtless really related to one another. The brighter one again shows double in a small telescope.

Hercules, Corona and Boötes occupy the western sky. In the northwest is Draco, with the Great Bear lower down. Still another of our stellar neighbors, Draconis, may be found as follows: About 1/3 of the way from δ Draconis toward β Cephei (shown on the map) is the fourth magnitude star ε Draconis. About 1/3 of the way back from this toward δ, and a little out of line, is the star we are seeking. Though a million times as far away as the sun, it may still be considered relatively near.

The Little Bear is on the left of the pole, and Cassiopeia and Cepheus on the right. The small star shown on the map between α and δ in the former constellation is Eta Cassiopeiæ, another stellar neighbor.

Below Cassiopeia, Perseus and Auriga are rising, while in the east are Arius and Pisces, with Andromeda and Pegasus above. Aquarius is well up in the southeast, and below is the Southern Fish, with the lonely bright star Fomalhaut — which, though much farther away than the stars already discussed, has the moderate distance of 23 light-years, and is some 25 times as bright as the sun.



At 11 o'clock: Aug. 7.
At 10½ o'clock: Aug. 14.
At 10 o'clock: Aug. 22.
At 9½ o'clock: August 29.
At 9 o'clock: Sept. 6.
At 8½ o'clock: Sept. 14.
At 8 o'clock: Sept. 21.

NIGHT SKY: AUGUST AND SEPTEMBER

THE PLANETS.

Mercury is evening star till the 26th, when he passes between us and the sun, and afterwards is morning star. He can be seen only at the beginning of the month, and not very well then, as he sets about 7:15 P. M. Venus is morning star, rising about 4 A. M. in the middle of the month. Mars is in conjunction with the sun on the 27th, and is invisible this month. Jupiter is evening star, setting about 8 P. M. on the 1st, and lost in the twilight before September ends.

Saturn is approaching opposition, and rises about 8 P. M. on the 15th. He is in the southern part of Aries, far from any bright star, and is conspicuous in the latter part of the evening.

Uranus is in Sagittarius and comes to the meridian at 7:51 P. M. on the 15th. Neptune is in Gemini, and rises a little after midnight.

The moon is new at 1 P. M. on the 3d, in her first quarter at 3 P. M. on the 11th, full at midnight on the 18th, and in her last quarter at 4 P. M. on the 25th. She is nearest us on the 21st, and farthest away on the 9th. In her circuit of the sky she passes by Venus on the 1st, Mars on the 4th, Mercury on the 5th, Jupiter on the 6th, Uranus on the 14th, Saturn on the 21st, and Neptune on the 26th.

A telescopic comet was discovered by the Rev. J. H. Metcalf, of Taunton, Mass., on August 9. On the 10th it was in R. A. 16 h. 10.5 m. Dec. 14 deg. 57 min. north, and was moving westward and a little to the north at the rate of a little over half a degree daily. It will probably remain visible in the evening sky for several weeks, but more cannot be said until its orbit has been computed.

Prof. T. D. A. Cockerell, of the University of Colorado, in Boulder, has recently published as paper No. 1754 in the Proceedings of the United States National Museum a paper entitled "The North American Bees of the Genus Nomia." It appears that in the collections of the National Museum there were a number of undescribed species of the genus *Nomia*, to which the late Dr. Ashmead had given manuscript names, but which he had never described. These Prof. Cockerell has examined, and in the present paper depicts for the first time five species, the types of which are in the National collections.

MAGIC FOR AMATEURS—VII

CARD TRICKS REQUIRING SIMPLE APPARATUS

BY W. H. RADCLIFFE

NO. 16. BEWILDERING DISAPPEARANCE AND REAPPEARANCE OF SELECTED CARDS.

The three active cards in this trick may be forced upon the chooser by successively slipping them out from the bottom of the pack as described in Trick No. 3, or by the use of a special pack* of 51 cards in which seventeen are all of a kind, as the ace of spades; another seventeen all of a different kind, as the three of clubs; and the remaining seventeen of a still different kind, say, the ten of diamonds.

If the latter method is used, the cards in the special pack should be previously stacked together in sets of three, one card of each of the three kinds constituting a set, and the cards in successive sets arranged in the same order. The order would therefore be: Ace of spades, three of clubs, ten of diamonds, ace of spades, three of clubs, ten of diamonds, etc., throughout the pack. Any three successive cards drawn from a pack thus arranged will each be different and of the suites composing the pack. The cards cannot, of course, be shuffled before the drawing, and although the chooser may draw the three cards from any part of the pack he must be cautioned to take them in successive order. In either of the two methods the performer knows in advance the cards which will be selected, and tacks duplicates of them under the seat of a chair, the occupant of which he later asks to make the selection.

The best way of vanishing the three chosen cards is by means of a box made as in Fig. 22. The upper and lower frames *m* and *n* are of wood and each must be of the same size; suitable dimensions are given in the illustration. The frames should be hinged at one side as indicated, so that when they are together the

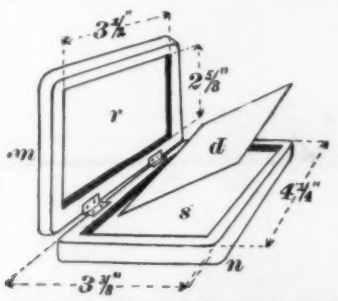


Fig. 22.—CARD BOX WITH INNER FLAP FOR MAKING A CARD DISAPPEAR.

inner edges will meet evenly. The covers *r* and *s* may be either of wood or cardboard. The entire inner surface of the box must be painted black. If black paint is not available, black ink may be used if it is applied a sufficient number of times to produce an even dark finish. The outer surface of the box may be painted or not, as desired, the only requisite being that the top and bottom be identical, and therefore indistinguishable from each other. A piece of thin stiff cardboard *d*, one-sixteenth inch less in length and width than the inside of the box and also painted black on both sides and on the edges, is placed in the box before beginning the trick.

After the three cards drawn have been noted by the chooser, he is requested to place them, faces downward, in the box, Fig. 22, which the performer now opens and shows to the audience. In showing the box, the performer should keep one finger pressed against the cardboard piece inside to prevent it falling out when the box is held upside down. The cardboard being thin and of the same color as the inside of the box will not then be distinguished from the latter. When the cards have been placed inside the box, the performer closes it, and in laying it on the table turns the bottom side up. The black cardboard which was formerly at the bottom of the box will then be on top, hiding the cards beneath it.

The performer now waves his wand or hands over the box in the direction of the chooser's chair, and then opens the receptacle. It appears empty because as previously explained the black cardboard is indistinguishable from its black interior. The performer suggests a thorough examination of the chair. To the astonishment of all the three selected cards are found securely tacked beneath the seat.

An excellent modification of the card trick just described is worked with two card boxes, each like the one in Fig. 22. Place a card face downward under the movable piece in each of the boxes, the cards used being different. Then force the audience to select duplicates of these two cards, either by the method in Trick No. 3 or by applying the instructions previously given in this trick to a special pack of two suites instead of three. After showing that the two card boxes are empty, have one of the chosen cards placed

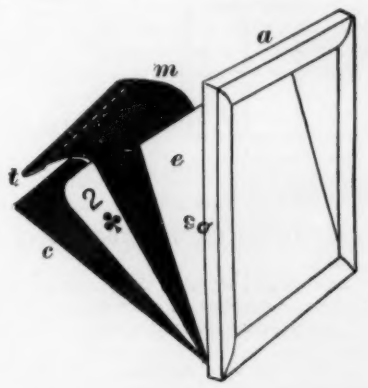


Fig. 23.—CARD FRAME LOADED FOR ACTION IN PRODUCING A CARD.

face upwards in each of them. Caution the audience to remember which box contains the one card and which box the other. Then close the boxes, place them upside down upon a table and command the cards to change places. Open the boxes and show that the cards have actually obeyed. If in replacing the boxes upon the table they again be turned upside down, the cards may be called back and exhibited in their original places.

NO. 17. CHOSEN CARD MYSTERIOUSLY FRAMED.

A pack of cards is offered to the audience to be shuffled and cut. While this is being done the performer comes forward with the trick envelope illustrated and described in Trick No. 7. In one of the compartments of this envelope a certain card from the pack—say the two of clubs—has previously been placed face inwards; the other compartment is left empty.

Laying the envelope card side down upon one of the audience chairs, or better still, placing it in his pocket where it can quickly be obtained, the performer takes the shuffled pack and spreading out the cards faces downward requests that a card be drawn and, without moving the hands after touching the card, be placed in an envelope which he will provide. The instruction about not moving the hand prevents the chooser from turning up the drawn card to see its face value. After the card has been inserted in the empty compartment of the trick envelope, the envelope is placed on a table or chair in full view of the audience. In placing it, however, the performer reverses the envelope, thereby bringing the two of clubs to the top.

The card box illustrated and described in Trick No. 16 is now brought forward and shown empty. The performer, holding this card box in one hand and the envelope in the other, requests the chooser to transfer his card from the envelope to the box and at the same time to note its face value, but not to allow the performer to see it.

This done, the box is laid on the table as previously

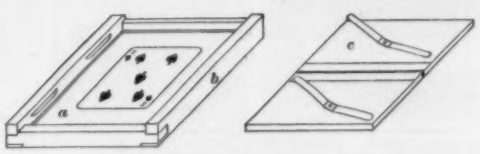


Fig. 24.—PHOTOGRAPHIC PRINTING FRAME. A CONVENIENT HIDING PLACE FOR A CARD.

described in Trick No. 16, the envelope is disposed of, and the card frame, Fig. 23, is brought forward. The card frame is easily made. It consists of the frame *a* having inside dimensions slightly larger than those of a playing card; a glass *e* fitted in the frame in the usual manner; a piece of cardboard *c* painted or inked black on one side and cut to fit inside the frame; a strip of black linen cloth *m* to act as a screen under the glass—in width a trifle less than that of the glass and one inch longer, with its end doubled over and sewed about a narrow strip of cardboard *t*; and a stout wire *s* inserted loosely in two holes bored through the sides of the frame to prevent the glass, etc., from falling out. One end of the wire should be bent round as shown in the illustration to facilitate handling it, and the other end should be cut flush with the farther edge of the frame so that it will offer no obstruction on that side.

The card frame is made ready for the trick by withdrawing the wire *s* and placing the black cloth next to the glass, its lower end even with the bottom of the glass and its upper cardboard end extending out and up from the frame. A duplicate of the forced card—the two of clubs in this case—is laid in the frame, face next to the cloth, and the black side of the prepared cardboard *c* next as shown in Fig. 23. The wire *s* is then inserted through the side holes to hold the parts in place.

Holding the card frame thus prepared in the left hand, the projecting part of the cloth pressed down against the back of the frame with the middle finger of the left hand, the performer shows the front of the frame to the audience. After calling attention to the frame being empty, he spreads a handkerchief over it, and supporting both with his left hand waves his right hand over the card box in the direction of the card frame.

He now opens the card box and shows it empty; grasps the handkerchief at the top of the card frame and through it the cardboard end of the cloth; then standing with his left side toward the audience, he lowers his left hand and brings the frame into view from beneath the handkerchief. The cloth remains hidden in the handkerchief, and the card, which the spectators have been led to believe is the one chosen from the pack, is seen nicely framed in the performer's hand.

The frame containing the card may be handed to the spectators to be opened by them, the performer

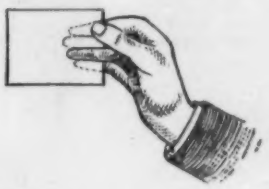


Fig. 25.—METHOD OF HOLDING A CARD FOR QUICK TURNING.

meanwhile pocketing the handkerchief and calling attention to how the black cardboard backing when the playing card is removed makes the frame appear as before.

An ordinary four by five-inch photographic printing frame, Fig. 24, may be used in place of the card frame here described, if more convenient. In such a case a duplicate of the forced card is pasted on a stiff piece of cardboard, *a*, cut to fit inside the printing frame *b*. The frame is prepared by placing the plain side of the cardboard next to the glass and then adjusting the back *c* in place.

The frame should be taken apart and shown to the audience previously to the supposed flight of the card. In taking apart the frame, raise the frame and glass off the cardboard instead of vice versa, so that the card side will not be seen. Then taking the cardboard in the right hand with the first two and fourth fingers beneath, and the thumb and third finger on top as in Fig. 25, pretend to show both sides to the audience; in reality show the plain side twice, making an extra half turn of the hand in turning over the card.

In replacing the cardboard in the frame, lay it with the card side next to the glass; after the back has been adjusted in place, spread the handkerchief over the frame before turning the front side toward the audience. All is ready then to proceed as before, the handkerchief merely having to be pulled off the frame to expose the card to view.

Red wax varnish is useful for painting parts of woodwork, wires of galvanometers and magnets. Small pellets of sealing wax are shaken up with warm methylated spirits and dissolved. The viscid liquid is applied with a small camel's hair brush in two or more coats, according to the thickness required.

*A pack of playing cards of this kind can be purchased for 25 cents from dealers in magical apparatus.

[The Editor of the Home Laboratory will be glad to receive any suggestions for this department and will pay for them, promptly, if available.]

A TOUCH-ME-NOT TRICK.

BY PROF. GUSTAVE MICHAUD, COSTA RICA STATE COLLEGE.

Every one knows the trick in which a silver dollar is laid at the bottom of a basin full of water, the assistants being invited to take it. The feat seems easy enough to perform, but the tremendous shock which no induction coil or electric appliance of any hand compels every one except the magician to give up the attempt. Here is a similar experiment, in which no induction coil nor electric appliance of any kind is used. No shock awaits the would-be owner of the dollar, but he feels sure that the jug is full of boiling water. He sees the steam wandering over it, and if he is not satisfied with that proof of the lurking danger, he may at any time make a trial attempt and dip into the water, for a very short time, one of his fingers. The painful sensation is conclusive.

You tuck up your shirt sleeve, to dispel any idea of fraud through the introduction of some chemical into the hot water, and slowly you dip your open hand into the burning liquid. You leave it there long enough, it seems, to have it boiled down, and

POURING THE HOT WATER LAYER OVER THE SALT WATER.

finally bring out the silver coin in your unharmed fingers.

The closest scrutiny fails at any time to reveal anything in the jug but the liquid and the dollar, yet during the first part of the experiment, the water is divided into two superposed layers which remain neatly separated, owing to a considerable difference in density. The upper layer is light because it is hot; the lower layer is much heavier for two reasons: it is cold and it contains as much table salt as it could be made to dissolve. Owing to the poor conductivity of liquids, the upper layer will remain hot as long as if there were no cold water under it. (An entirely different result would be, of course, observed if the cold layer were the lighter and stood above; loss of heat through convection in the hot layer would then rapidly take place.) When you take the jug to bring it before you, one rotary jerk is enough to mix the two layers after a few seconds, and in the resulting lukewarm water your hand may remain as long as you choose.

Contrarily to what might be expected, the filling of the jug with the two liquid layers offers no difficulty whatever, and is a pretty experiment which can be done in a moment by anyone if the following rules be observed:

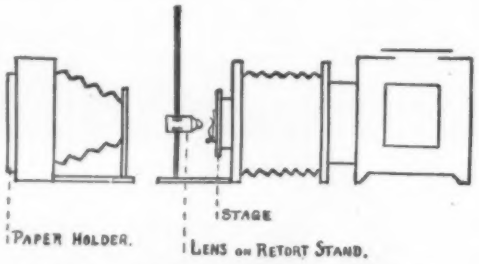
Lay the silver dollar on the bottom of the jug, then pour over it the saturated solution of salt, so as to fill with it about two-thirds of the vessel. Close partially the spout of a common funnel with a square piece of cork, so as to get a few tiny jets instead of one large one. Over the salt solution lay a large flat cork stopper. With the funnel pour the boiling water directly upon the cork stopper. Being thus broken by their fall over the cork, the hot-water jets will run smoothly and almost horizontally over the salt-water layer, and no appreciable mixing will take place.

It is obvious that the vessel must be of crockery, porcelain, or glass and not of metal, as the latter, through its great conductivity, would tend to bring about equilibrium of temperature.

HOME-BUILT APPARATUS FOR MAKING PHOTO-MICROGRAPHS.

BY T. J. MOON.

The essential parts of an apparatus for making photo-micrographs are three: First, a source of strong light in parallel rays if possible; second, a fixture for holding the slide and magnifying lenses; third, a fix-



APPARATUS FOR MAKING PHOTO-MICROGRAPHS.

ture for holding and exposing the photographic paper. These had to be supplied in constructing the apparatus used in the school where the writer is instructor of biology.

For the first we were fortunate in having in our laboratory an excellent arc light stereopticon, from which the front lenses were removed, and light taken directly from the condensers. Any similar source of light could be utilized, such as acetylene or oxy-hydrogen, where electricity is not available.

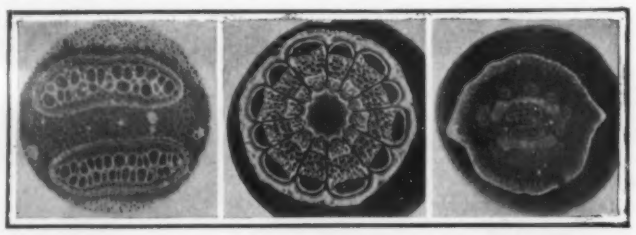
As to the second part of the apparatus, a thin board with a clean hole of about five-eighths inch diameter can be fastened across the opening left by the removal of the front lenses of the lantern, and in this two clips from a microscope stage can be set to hold the slide, forming a vertical "stage" for the lantern. (Rubber bands can be used in place of the clips.) To hold the lens, a retort stand and clamp may be used, care being taken to have the hole in the stage and the lenses accurately in the axis of the beam of light. Alignment can be secured by setting the base of the retort stand against the stereopticon, or against a straight edge attached to its base. Focus can be obtained by moving the stand nearer to or farther from the stage. The lenses used were ¾, ½, 2/3-inch objectives from an ordinary microscope; 1/6 was also tried, but except with unusually clear slides was too powerful for clear definition. We finally used an apparatus that screwed into the front of the lantern, carrying a stage and lens holder that focused by rack and pinions. Such an arrangement saves time, and can be purchased of dealers in optical goods.

The unique feature of our process was the substitution of gas-light paper for plates, resulting in white details on a black ground in the prints, but especially in great economy of time and money. The paper (4 x 5 was used) can be had cheaply, and if a sheet is spoiled no great loss is caused; while plates, more sensitive and more easily injured, are likewise more expensive. As to time, once the slide is focused, exposures can be made in from one to three seconds, which is quicker than a print can be made from a negative.

To hold this paper, two metal clips were inserted in ordinary 4 x 5 plate holders. To support the plate holders, the lens board was removed from a camera, and the camera box fastened adjustably to the table, so that it could be set near the lens or at a distance, thus regulating the size of the print and the sharpness of definition.

To make a print, the light was turned on, the slide inserted, and the image focused on the ground glass of the camera by moving both the lens at the stage and the camera itself. Then a piece of cardboard was interposed to shut off the beam of light; the paper-filled plate holder was put in place; and the exposure was made by raising the cardboard. The exposure varied from one to three seconds. The print was developed at once and its accuracy judged, so that any necessary alteration could be made in the adjustments. The light escaping from the lantern was not sufficient to fog the paper, and the room was only darkened as usual for projection work. We found that papers with glossy surfaces give the best results. The slides should be balsam mounts, as glycerine will not stand the heat, and even balsam slides must not remain too long in the path of the light. A sheet of mica behind the condensers helps to shut out the heat. Various stains differ in ability to impress the photo paper, so that trials of several sorts are necessary. The different red and green stains worked best; very thin or opaque tissues do not give good results.

Prints of stem and leaf sections, wood structure, and general histological studies have been made as above, and are now in use in our laboratories. The accompanying illustrations are reduced reproductions of the original photo-micrographs. The cross section of a clematis stem is particularly interesting. Because of its symmetry and apparent design it has been mistaken for the picture of some kind of lace centerpiece. It shows the various elements of the vascular bundles and their complete isolation from each other, permitting flexibility in climbing, on the principle of the strands of a cable. In connection with this work I wish to acknowledge the help of Prof. H. J. Lathrop, whose aid was invaluable in the whole process.



Concentric vascular bundles in Pteris aquilina. Clematis stem, C. verticillaris, D. C. Section of Rhizome of Pteris aquilina.

PHOTO-MICROGRAPHS MADE WITH HOME-BUILT APPARATUS.

A SIMPLE WIRELESS TELEPHONE.

BY ALAN S. DANA.

The following simple apparatus will enable any one to hear articulate speech 55 feet through any number

METHOD OF TRANSMITTING MUSIC FROM TALKING MACHINE.

of walls or other obstructions without any wire connection, while with the same instrument the music of a phonograph may be heard distinctly a distance of 67 feet.

The transmitting apparatus consists of three parts: Transmitter, sending coil and battery. I use a twenty-five-volt transmitter, which, I find, works better than one made for lower voltage. The sending coil is made by using two pounds of No. 18 copper wire formed into a circle 4 feet in diameter, the wire being held in shape by winding it with rubber tape, thus making a neat finish. By using the same length of No. 16 or No. 14 wire the sending distance can be increased. In order to get the circular form I drove nails into the floor in a circle, carrying the wire around them until the requisite length of wire was used. Wooden dowels were used to keep the circle formed by the wire in a stiff and portable form.

A six-volt storage battery is used, supplying about one ampere, but naturally a battery of greater voltage will increase the sending distance. A press-button switch to connect the battery when one is speaking completes the sending end.

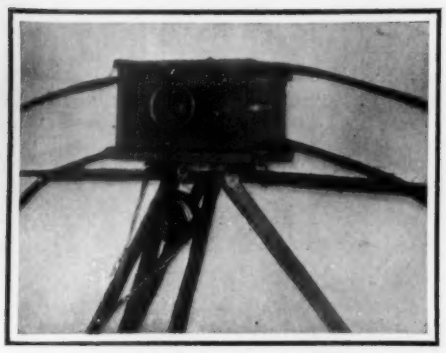
A similar coil and a receiver are needed for the receiving end. The coil is formed in the same manner as the first mentioned one, only that two pounds of No. 24 copper wire are used, but a greater length of wire would increase the range of the set.

The receiver used is a 1,500 ohm wireless telegraph, but I find one of a 1,000 ohms is practically as good.

Either of these is much better than the usual 75-ohm receiver. Of course the principle involved is that of induction, and obviously it is necessary to have two sets of the apparatus. The alternating current in one coil inductively sets up a current of like nature in the other coil which operates the receiver.

One of the accompanying photographs shows the transmitter connected to a talking machine by use of a galvanized iron horn, the larger end of which takes the place of the horn of the machine, while the smaller end enters a block of wood. Another hole is made in the wooden block at right angles to the first hole and at the end of this the transmitter is placed.

Another photograph shows one complete set of sending coil, battery, transmitter switch, receiving coil and receiver. The box on the tripod contains the six-volt storage battery. Altogether it makes a light, portable apparatus. As I have two sets, they are sometimes combined in order to get greater distance of transmitting, as shown in Fig. 2.



THE TRANSMITTER AND RECEIVER, SHOWING PARTS OF COILS.

By the following table one will note that music may be heard a greater distance than speech. One set sends speech 31 feet with 6 volts, sends speech 38 feet with 12 volts, sends music 46 feet with 6 volts, sends music 51 feet with 12 volts. Two sets combined send speech 50 feet with 6 volts, send speech 55 feet with 12 volts, send music 58 feet with 6 volts, send music 67 feet with 12 volts.

Should the reader give as much enjoyment to his friends as I have he will be well repaid in making the sets.

COATING METALS AND ALLOYS BY IMMERSION.

BY A. J. JARMAN.

When a thin coating of metal is required upon small articles where the number may run into the hundreds or when it is only necessary to give a surface coating to an article that is not exposed to everyday wear and tear, the following solutions will be found to answer all ordinary requirements and give an excellent deposit of metal. In nearly every instance it will be necessary to use the scratch brush where the articles are of moderate size. Sometimes it will be found advantageous to burnish the prominent parts only, leaving the remaining parts "dead."

The coating of iron and steel articles by dipping or immersion can be accomplished by a solution that must be made and kept away from strong light, but for copper and brass goods the following solution, which is not affected by light, will answer, and give a very good deposit:

Silvering Solution for Copper or Brass.—Distilled water, 20 ounces; bisulphite of sodium, 20 ounces. When dissolved add the following solution: Distilled water, 5 ounces; nitrate of silver, 520 grains. Be sure that the nitrate of silver is all dissolved. Add this to the bisulphite mixture and filter through absorbent cotton. The articles must be left in this solution for several minutes. Then should be removed and be dipped several times in a 5 per cent solution of carbonate of soda, after which they should be washed and polished.

Silvering Solution for Iron and Steel.—Dissolve 1 ounce of nitrate of silver in 40 ounces of distilled water, stir this well with a glass strip or rod. Use neither wood or metal for stirring. Now make up a solution of hyposulphite of soda, 3 or 4 ounces in 6 ounces of water. Add very carefully a small quantity of this to the nitrate of silver solution and stir well. A brownish precipitate will form. Add a little more of the hyposulphite solution, stir again, and so on, until the solution becomes clear. Now add just a little more of the hyposulphite solution and the mixture will then be ready for use. Clean the articles well by first soaking them in a hot solution of common washing soda; rinse well; scour with pumice powder and a stiff nail brush, or for small articles a stiff tooth brush; rinse them and place them in the solution. The coating of silver from this solution is a moderate one. Silver can be deposited upon steel, brass and German silver by rubbing the solution upon the article with a soft sponge or a clean piece of rag.

Coating Zinc Articles With Copper.—Dissolve 5 ounces of chloride of copper in 4 ounces of distilled water. Add thereto, stirring all the while, about 7½ ounces of strong ammonia, and 150 ounces of distilled water. Make up a strong solution of cyanide of potassium, about 8 ounces in 20 ounces of water. Add this slowly to the blue solution of copper; in fact, add only just enough to disperse the blue color or nearly so. Clean the zinc articles thoroughly and immerse them in this solution. They will receive an excellent coating of copper, the coating adhering firmly to the zinc. If made slightly warm the deposit will become increased. This is advisable in cold weather only.

The Deposition of Tin by Simple Immersion.—Take 18 ounces of ammoniacal alum and dissolve in 18 pints of distilled water while boiling. As soon as this is dissolved add one ounce of protochloride of tin. Stir this well while adding a little at a time. The articles to be coated must be thoroughly cleaned, as for silver plating, and then suspended on a soft copper or brass wire and moved about in the hot liquid. Articles so treated will quickly receive a fine white deposit of tin. To deposit this upon lead, iron or steel, also copper and brass, the following solution will answer well: Take 10 ounces of bitartrate of potash in 2 gallons of water, add ¾ ounce of protochloride of tin. Bring this solution to a boil, and in a few minutes the tin salt will dissolve. Clean the articles well and attach to them a piece of zinc. Then immerse and move the articles about in the liquid, when a fine deposit of tin will take place quickly. In some instances the articles will have to be scratch brushed, or even burnished. When finished they will be found scarcely inferior in appearance to some silver-plated articles.

Depositing Gold by Immersion.—Dissolve in one pint of distilled water 2 ounces of hyposulphite of soda. In 3 ounces of distilled water dissolve 120 grains of chloride of gold, add this gradually to the hyposulphite solution, stirring well with a glass rod. The precipitate that forms by this addition dissolves almost instantly. Articles to be gilded in this solution must be thoroughly cleaned. Boil them for a few minutes in a solution of common washing soda, then rinse and scour with fine pumice powder, or scratch brush them, always taking care that the hand which holds the article is dipped into the pumice powder so as to prevent any trace of grease from coming into contact with the article. When scratch brushing must be resorted to, it will be found to be a good plan to wash the hands well in a weak solution of carbonate of ammonia, and then rinse them in clean water. This little dodge will prove quite effective in removing the greasy matter which usually accompanies free perspiration. It also corrects any trace of acidity of lactic acid that is exuded through the pores of the skin. Articles so cleaned can be suspended on a piece of copper wire, and moved about. Deposition quickly takes place, especially if suspended by a thin strip of zinc, or a piece of zinc wire.

It must be clearly understood that articles that have been coated with either silver or gold will not resist much wear.

If these plating liquids are made more concentrated they can be used to render various designs in gold and silver by touching the article with a strip of zinc to start electrolytic action. Different designs in silver and gold can be thus made, without stopping off the plating with insulating varnish, as is necessary in electro-plating. The solutions given above are of use also for electro-platers to coat that part of an article that has become chipped or slightly stripped, and thus save the time and cost of replating.

A SOAP BUBBLE CELEBRATION.

To the Editor of the Home Laboratory Department:

In out town of Berkeley we have a new government which will not let little boys have any fireworks on the Fourth of July.

My father thought that was a good idea, but he wanted me to have a good time on the Fourth of July just the same, so he got up this experiment for me and my friends instead of fireworks.

He took about a quarter of a pint of Italian olive oil and boiled it about two hours with about four ounces of common caustic potash, such as is used for wool washing, he dissolved the potash in about half a pint of water before boiling it with the oil. After the mixture had been boiled two hours the soap was ready, and he strained the extra water and potash off after the mixture had gotten stone cold and stood over night.

The next morning, which was Fourth of July, he got the biggest dish-pan in the house, about two and one-half feet across, and he made up a solution of the soap in about four gallons of water, then he took the garden hose and fastened it to one of the larger gas pipes in the cellar and put the other end in the bowl of soap water, and then turned on the gas. The dish-pan quickly filled up with a mass of bubbles all fastened together, each bubble being about as big as my fist, and then because they were so light on account of being filled with gas they began to try to rise up, but they were so stuck to the soap water that they did not break away till there was a mass of them nearly as big as the largest sized watermelon, then they sailed away and we watched them till they were out of sight. As soon as one bunch of bubbles had sailed off another bunch began to form, and sometimes we could see as many as twenty in the air at once.

Some of them we could watch as long as three and a half minutes by the watch before they went clear out of sight. We kept up the game several hours, and the amount of gas used up was 32 cents' worth, which was a cheap enough Fourth of July.

CRAIK SPEED.

Berkeley, California.

SIMPLE LABORATORY THERMOSTAT.

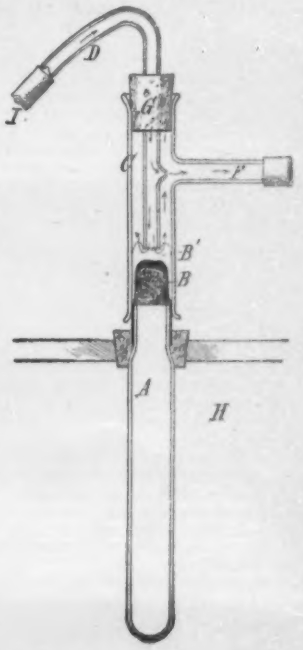
BY GEORGE A. JAMES.

The accompanying drawing shows how a simple and yet accurate laboratory thermostat may be made at home. It comprises two tubes, *A* and *C*, which are formed out of test tubes twelve millimeters (½-inch) in diameter. The tube *A* is heated until, by melting, it contracts sufficiently to enter the other tube a distance of about two centimeters (¾ inch). It should fit this tube snugly when covered with a rubber finger-cot *B*. The value of the apparatus depends on this detail. The finger-cot is of the thinnest quality, such as is used by surgeons, and the smallest size obtainable should be selected, so that it will fit tightly over the end of the tube *A*. In order to insure a gas-tight joint, it will be well to wrap the cot *B* below the point where it enters the tube *C*. I find a thin rubber band stretched and doubled repeatedly over the part insures a tight fit. Before covering it is well to see that the tube is dry inside. I place mine in a desiccator before covering.

The glass blowing of part *C* is not beyond the ability of most chemists, and although it is best to make this part compact, the length has no particular importance. Three inches is about right.

The bent tube *D* is passed through cork *C* and must fit snugly, although not too tightly to prevent slipping up or down. It is then bent as in the drawing and the small teat (or by-pass) is blown on one side. This should have a minute opening (about the size of a small brass pin). The part *A* enters the space, or liquid, the temperature of which is to be controlled, through a cork of sufficient size to prevent the heat from injuring the rubber tip. Gas enters at *I*, passes through *D* and out at *F* to the burner used to heat apparatus *H*.

When heat of *H* reaches the desired degree, the tube D is pressed down on the nipple *B* until only gas passing through the by-pass *E* enters the burner. As the temperature of apparatus decreases, the air in *A* contracts and nipple *B* recedes from the end of tube *D*, increasing the supply of gas to burner, and restoring the desired temperature.



HOME-MADE THERMOSTAT.

The object of the by-pass *E* is to prevent the total extinguishing of gas flame.

There are four ways of controlling the thermostat. First, by the distance of tube from the rubber nipple. Second, by the distance the part *A* enters the heat zone. Third, by the gas cock regulating the supply of gas. Fourth, by the nearness of flame to the apparatus heated.

The apparatus, when made of glass, will control temperatures within two degrees in a comparatively small volume of heated air or liquid, but if metal (as copper, or silver) is substituted, or the tube *A* is made in the form of a box with larger volume, it would obviously permit almost any degree of sensitiveness.

GEO. A. JAMES.

In the SCIENTIFIC AMERICAN of June 25th there appeared an article on a polariscope attachment for microscopes. The author's name was inadvertently omitted. The author is Mr. C. C. Kiplinger.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

DEVICE FOR DETECTING WAVES IN WIRELESS TELEGRAPHY.—G. C. ELLWOOD, Arbuckle, Cal. An object of this invention is to provide a receiving system in which the apparatus may be tuned by means of variable resistances and inductances. Another object is to provide a form of variable inductances in which indicators may be set at the proper place to cut in or out coils and to give the desired inductance.

Of Interest to Farmers.

COTTON-PICKER.—F. J. BROOKS, Glencoe, Okla. This picker engages the cotton as the machine is passed over the plants drawing the cotton from the bolls and automatically discharging it into the proper receptacles. The operating parts may be readily raised or lowered to accommodate plants of different heights by a simple cam and lever mechanism.

SELF-LOADING HAY-RACK.—R. SHOCK, Rockford, Ohio. In this patent the objects are: to provide racks having extensible and collapsible body portions; to provide means for distributing the load evenly throughout the vehicle to which the invention is applied; to provide means for loading the vehicle by means of the running gear thereof; and to provide means for automatically disengaging the loading means.

Of General Interest.

SHOE.—A. H. PRENZEL, Halifax, Pa. Mr. Prenzel's invention relates to improvements in shoes and is more particularly applicable to those shoes designed for the use of children, in which a wedge is inserted under the heel seat to raise the heel, while at the same time preserving the continuity of the bottom from the front to the extreme rear. The heel seat is secured by sewing it to the upper by a machine.

SEAL AND KNOT-PROTECTOR.—M. DRESAUER and S. RABUCH, New York, N. Y. This protector is an improvement in those employed for preventing the untying or removal of the cord from a package, bag, or box. The object of the invention is to so construct the device that no special details or implements of any kind whatsoever are required in applying it, the protector being of such a character that it must be destroyed or mutilated or the cord cut, in order to open the package.

VARNISH.—F. EPHRAIM, Santa Barbara, Cal. This invention pertains to substances extracted from certain plants and more particularly to shellac-like gum extracted from the ocotillo, one species being the *Fouquiera splendens*. By proper manipulation, a gum can be extracted from this plant having many properties of shellac and workable into varnishes.

EXTENSION FIRE-LADDER.—J. DUPUIS, Fall River, Mass. This ladder is of the emergency type for use especially as fire apparatus. It may be more easily and quickly raised to position than other ladders of a similar type, owing to the use of a series of springs, which, when the apparatus is in a normal position of disuse, are under a great strain. Persons may assemble on its receiving platform, which is lowered in horizontal position.

EYE-PIECE FOR MAGNIFYING INSTRUMENTS.—J. N. ARRIAGA, Mexico City, Mexico. This invention relates to an eye-piece for microscopes, telescopes, field glasses, opera glasses, etc. The aim of the improvement is to produce an eye-piece which will operate to increase the magnifying power of the instrument, and increase, also, its range and capacity for magnifying.

VENTILATOR.—D. H. MOWEN, Hagerstown, Md. This ventilator is adapted to be utilized in any place where it is desired to have a draft or change of air without intrusion of dust or rain, no matter in which direction the wind is blowing, or the member to which it is attached is moving. It may be attached to a building, a street or a railroad car, or any other member to produce an efficient circulation of air.

TRAP-GUN.—W. M. LINDSEY, Sonora, Texas. This device has a support adapted to be forced into the ground or other object, and on which the gun proper is mounted to swing both horizontally and vertically, whereby the gun is adapted to be automatically aimed to the point desired by the pull on the firing lanyard.

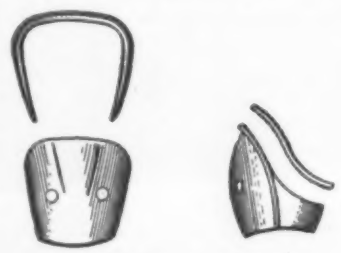
PHOTOGRAPHIC APPARATUS.—J. LEONARD and W. J. OLDAKER, Chicago, Ill. In this apparatus provision is made for introducing into a photograph at the time of exposing the sensitized plate, a background to the subject being photographed, which subject is not actually present, and accomplishes the result so that the finished photograph will present a single, compact, and natural picture which will appear as if the principal subject had been photographed together with and in the actual presence of the subjects thus introduced.

HORSESHOE.—J. H. KIEFFER, Allentown, Pa. Among the principal objects in view in this case are: to provide a shoe and removable calks therefor, the attachment whereof is simple and easy of application; to provide means for attaching removable calks to horseshoes by wedging the same therein and preventing the loosening by auxiliary fastening devices; and to lighten the construction of the shoe without decreasing its durability or increasing its cost.

DEVICE FOR ELEVATING WATER.—J. R. HALL, Winnfield, La. In this device the raising of water may be accomplished continuously by means of centrifugal action. Means provide for permitting the water to flow outwardly in a lateral direction from the top of the main pipe and for regulating such flow in a manner to cause the force of the outward flow to lift the water in the central tube.

STRAW HOLDER AND DISPENSER.—J. GILBERT, Nashville, Tenn. This invention is an improved apparatus for holding and dispensing straws used in connection with soda-fountains and elsewhere. It is embodied in the construction of the body of the straw-holder, and in the construction, arrangement, and attachment of the means by which the straws are dispensed or delivered from the same.

CROWN FOR TEETH.—MONTAGUE HART TUTTLE, D.D.S., 630 Chandler Building, Atlanta, Ga. The crown here illustrated does away with the necessity of anchorage pins, and hence does not require destroying the nerves of the tooth, nor does it entail danger of injuring the roots. It consists of a flat band of metal which may be bent around the tooth to form the body of the crown, while a



IMPROVED CROWN FOR TEETH.

piece of platinum of horseshoe shape is fitted over the body, dividing the band into labial and lingual portions. The labial portion is adapted to receive a veneer of porcelain, while a cap is fitted over the lingual portion. After the crown has been baked and soldered and thoroughly finished, it may be set on the stump of the tooth and can be as thoroughly articulated in the process of construction as any other crown.

Heating and Lighting.

SMOKE-CONSUMER.—C. SORENSEN, Gulfport, Miss. In this instance the purpose of the invention is to provide a simple and inexpensive device for attachment to heating plants, for perfectly consuming all of the combustible portions of the fuel, by passing the products of combustion repeatedly through the fire box, with a suitable mixture of air.

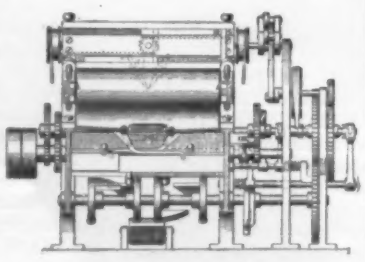
Household Utilities.

HOLDER FOR FLY-CATCHING PAPER.—H. PIEPER, Uehling, Neb. The purpose of this improvement is to provide a holder frame of novel, simple construction, whereon sticky fly paper may be removably mounted and supported horizontally at a window on the meeting rail of the lower sash, for an exposure of the fly paper where flies seek the light and are liable to be caught by their contact with the paper.

Machines and Mechanical Devices.

HEADING-MACHINE.—J. E. JOHNSTON, Farmville, Va. This device is for use in making heads of barrels, casks and hogsheads. Certain of the pieces which form the heads may be cut while assembled in the relation which they are to occupy when in the completed head, thereby insuring the cutting of the pieces in the proper curves.

PULP-LAP-FORMING MACHINE.—JAMES P. MCCREADY, 129 Main Street, Berlin, N. H. The accompanying illustration shows a machine adapted to form laps of any desired thickness and to sever and fold the laps in



PULP-LAP-FORMING MACHINE.

shapes of constant dimensions. Means are provided for regulating the quantity of pulp utilized to form the laps, and automatic controlling devices are provided for governing the action of the mechanism so as to harmonize the operations of the various sections.

CLOTH DAMPENING AND SHRINKING MACHINE.—R. M. DALGLEISH, New York, N. Y. Broadly defined, this invention consists of two operatively-connected mechanisms, each for dampening, shrinking and folding lengths of material, and means for alternately actuating the mechanisms to apply a length of material to one of them and simultaneously therewith remove and fold the finished length of material from the other.

WAVE-MOTOR.—E. H. ANGELL, Berkeley, Cal. More particularly the invention relates to motors which can be adjusted to allow for tidal or other variations in the water level, and which have continuously traveling series of vanes arranged to receive the water impact, and transform the interrupted and discontinuous movement of the waves or other water fluctuations, into substantially continuous power-producing movements of the mechanism.

SCRAPER.—SAMUEL F. VOSE, 314 North Oklahoma Avenue, Shawnee, Okla. Pictured in the accompanying illustration is a scraper comprising a scoop mounted upon a frame and adapted for use in removing earth or other materials in making excavations, earth fills, and the like. The machine requires but little power to operate it, and can be controlled by a single person with little difficulty. The

MACHINE FOR REMOVING EARTH.

scoop not only loosens the material, but serves also as a carrier to transport the material from one point to another, and may also be operated to dump the material at any desired place.

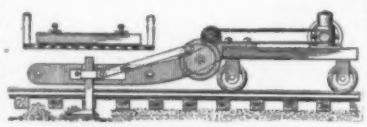
Prime Movers and Their Accessories.

WOOD BENDING AND HARDENING MACHINE.—M. S. E. ANDUAGA and H. BOURBELLY, Lima, Peru. This invention provides a method for bending wood and setting it in bended shape; provides for successively and continuously operating to bend and set wood strips singly or in groups; and provides for feeding wood strips under pressure between rollers disposed to gradually bend the strips to desired curvature.

AUTOMATIC PUMP FOR INTERNAL-COMBUSTION ENGINES.—R. W. J. SMITH, Terrell, Texas. In this device the cleaning of the cylinder of its residual gases or products is accomplished automatically. The invention provides means for the introduction into the cylinder of the engine, of an explosive charge of gas for driving the piston and a stream of air through the same inlet port for scavenging or cleaning the cylinder, these operations following each other in regular sequence.

Railways and Their Accessories.

RAILROAD TAMPING MACHINE.—JOHN MCCLELLAN, McGill, Nev. The present invention provides a machine for leveling and tamping railroad beds and ballast. The particular objects of the invention are to furnish



RAILROAD TAMPING MACHINE.

a mechanism for doing the work of spreading and tamping rapidly and continuously to permit of tamping backward, so as to leave completed work in the rear of the machine, and to furnish a tamping bar which may be detached and left in operative position while the machine is removed to clear the track.

TRUCK.—G. E. ROW, Omaha, Neb. This invention is particularly for use for railway cars and the like, and has for an object to provide a truck in which the separate wheel-sets can be independently and quickly removed from the truck body, the truck, when assembled, possessing shock-absorbing features, adapted to minimize the jarring of the car body, occasioned by the contact of the wheels and rails.

RAILWAY-RAIL FASTENING FOR RAILWAY-TIES.—R. T. KIRKLAND, Adams, N. Y. This fastener is of use particularly on reinforced concrete or other railway ties. The body of the tie is provided with a metal reinforce extending through it longitudinally, and to such reinforce is attached a metal plate forming the flat top of the tie. The fastening is applied to the plate and is adjustable lengthwise thereof to adapt it for application to the base flange of the rail. The fastening includes a clip, adapted for application to the tie plate, and provided with a lateral flange or lip for engaging the base of a rail, and a grooved wedge, which engages the clip and by whose adjustment it clamps the latter in any required place.

Pertaining to Vehicles.

VEHICLE-SHAFT ATTACHMENT.—H. M. POWELL, Omaha, Ga. The aim here is to provide a device for attachment to shafts of a buggy or like vehicle, and provided with yielding means to which the trace may be attached, thus dispensing with a swingletree and relieving the shoulders of the draft animal from jerks caused by obstructions.

Designs.

DESIGN FOR A SPOON, FORK, OR SIMILAR ARTICLE.—M. A. ANZELWITZ, New York, N. Y. This graceful and ornamental spoon is designed in a way to allow the handle to serve at its bowl end as one for a knife, fork, or similar article. The lines of curvature are unique and the top surface of the handle is marked with emblems that give an artistic and effective result.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Notes and Queries.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of June 18th, 1910, or will be sent by mail on request.

(12277) G. C. asks: I am quite certain that in an old book on Physics I read that sound could be refracted, somewhat as light is, i. e., by things shaped like lenses for refracting light. The action was somewhat similar, retarding the sound in certain places more than in others. I have since lost the book, but I now have three recent ones on Physics; though I've looked through all of them, I haven't found anything about the refraction of sound. I wish to know whether sound can be refracted or not? A. Sound is refracted with perfect ease, by passing from air of one density to air of another. This often happens. Sound zones result, so that a sound may be heard in one place and not be heard in another place nearer the origin of the sound. Much may be found on this matter in Tyndall's Sound, which we send for $2. Tyndall described a sound lens for the refraction of sound waves.

(12278) J. C. writes: I am writing you about an observation that I have made many times, and until I had called the attention of many of my friends to it I did not know that what I saw was not familiar to everybody, but they all expressed surprise at the common-place thing. Hence I am writing you. Place two electric buzz fans facing each other at a distance of fifteen feet; turn one fan on at low speed, turn on the other fan at fast speed, and stand behind same fan. Look through said fan and observe that other fan, which is turning at a slower speed, seems to be at a very, very low speed, and is turning in an opposite direction from what it really is. By reversing speeds on each fan and taking same view as before, you will see that the third imaginary fan has a reversed direction, yet both fans are running in the same directions as before. If this phenomena or optical illusion has any scientific worth, or can be explained by you, I should appreciate a reply to this communication. Otherwise I will not expect you to give it any attention. A. The optical illusion which you describe is called a stroboscopic effect, and is fully explained with other illustrations in Hopkins's Experimental Science, which we can send for $5 by express prepaid. This valuable work, in two volumes, ought to be in the hands of every one who is interested in such a phenomenon. We have sold a great many thousand copies of the work. The explanation is very much the same as that of the moving picture machine.

(12279) T. O. W. says: Will you kindly give some idea as to how long a thoroughly galvanized metal, as sheet iron, should last when placed in ordinary soil and left there permanently? What is the best known cheap substance for making a lasting soil-waterproof receptacle, other than glass and pottery (glazed)? A. We could not even guess the length of time which galvanized metal would last under ground. It depends entirely upon the condition of the soil, the nature of the minerals present, and very much also upon the presence or absence of electric current, as from trolley lines adjacent. The best method of making a tank to be placed under ground is to build it of good heavy black sheet iron and paint it thoroughly with two or three coats of some preserving compound or iron paint. To build a receptacle under ground, of something other than metal, reinforced concrete would be very serviceable. You can find considerable information on concrete construction in the previous issues of the SCIENTIFIC AMERICAN SUPPLEMENT.

(12280) M. M. L. says: Would you kindly inform me the correct method to erect

a sun-dial—a horizontal one—in latitude 42 deg. N. I understand that the stylus is to point due north and to form an angle of 42 deg. (the latitude) with the plane of the dial, but do not know at what spacing I should draw the hour lines upon the face of such a dial. A. You are quite correct in stating that the stylus of a sun-dial must be placed accurately in the meridian of the place where it is set up, that is, it must stand north and south, and the angle of the stylus with the base must be equal to the latitude of the place. The base must be horizontal. The angles for the hours may be calculated by trigonometry. Trautwine's Civil Engineer's Pocket Book contains full instructions for laying out a dial for any latitude by drafting to five or ten minute marks. We send the book for $5 postpaid. The SCIENTIFIC AMERICAN, June 6 and 13, 1908, gives full instructions for calculating the angles for the hours. The same process can be applied to the half hours or any other division of time.

NEW BOOKS, ETC.

STRENGTH OF MATERIAL. An Elementary Study Prepared for the Use of Midshipmen at the U. S. Naval Academy. By H. E. Smith. New York: John Wiley & Sons, 1909. 12mo.; 170 pp.; cloth. Price, $1.25 net.

The author of this work is Professor of Mathematics in the United States Navy, and he has produced an admirable book which will be found of great value to engineers.

PRACTICAL HINTS TO TRAVELERS IN THE NEAR EAST. By E. A. Reynolds-Ball. London: E. Marlborough & Co., 1910. 16mo.; 140 pp. Price, 80 cents; cloth, $1.

This hand book for Eastern travelers is intended to serve as a companion or supplement volume to the guide books dealing with Morocco, Algeria, Tunis, Egypt, the Nile, Assyria, Palestine, Turkey, Greece, and Cyprus and Malta, while the general hints and suggestions given will be found serviceable over a much more extended field of travel. The above mentioned countries are beginning to be largely visited by tourists, but in comparison with such resorts as Switzerland, Italy, Norway, and other countries of Western Europe, they are still but little known; and it is believed therefore, that such a vade mecum will prove of considerable service to travelers. There is no doubt that the Near East demands more preparations and fuller consideration as to outlay, equipment, and general arrangements than are required in the case of Continental travel, and such information is very sparingly given in the standard guide books. The aim, then, of this book is to provide the fullest, most precise, and most recent information on the many details which so closely concern the convenience and comfort of the traveler. Questions as to water, food, fuel, knapsacks, lighting of a match in the open, maps, etc., are admirably treated. There are also excellent collections of medical hints which are of considerable value. There is also a *résumé* of the legal aspect of hotel visitors in France; the notorious robbery of English-speaking people in France in the case of sickness and death has been going on for years and it is gratifying to note that at last the hotel proprietor seems to have gotten down to a business basis, although a high one, and he has something like fixed charges, and in some places even a sliding scale has been adopted. All these and many more points are admirably brought out in this very useful little volume.

THE MOTOR ROUTES OF FRANCE TO THE CHATEAUX OF TOURAINE, BAYEUX, THE PYRENNES, THE RIVIERA, AND THE RHONE VALLEY. By Gordon Home. London: Adam & Charles Black, 1910. New York: The Macmillan Company. 8vo.; 444 pp. Price, $2.

The fascination of a motor tour through France can hardly be exaggerated. It is a country eminently suited to the new method of road travel, for, with the spaces between the towns traversed by wide national ways going to their objective as straight as the contours of the country will permit, no one feels that the presence of the rapid car is destroying the peace or beauty of the neighborhood. This book embodies the very best features of all of the road books. The plans of cities and roads are on a large scale, and are extremely well executed. There are tables of distances, notes for drivers, and a complete catalogue of places of interest on the route. The book is also accompanied by interesting monochromes and colored engravings. There is also a splendid map giving all of the best routes in the section of France which is dealt with in the present volume.

THE QUEEN NEWSPAPER BOOK OF TRAVEL. A Guide to Home and Foreign Resorts, compiled by the Travel Editor, M. Hornsby. London: Horace Cox, 1910. 16mo.; 462 pp. Price, $1.

This is one of the most valuable books which the traveler can have and no one who has not edited a Hand Book of Travel can have any idea of the labor involved in producing a creditable book of this kind. It is admirably printed on light weight paper, with round corners, so as to slip nicely into the pocket. It contains practical information on over fifteen resorts, also gives reliable details on routes and fares to resorts all over Europe, giving their climates, seasons, amusements, hotels, foreign currency, etc. It contains a list of schools for English-speaking pupils on the Continent; it also gives additional information on British and Continental places already described in former editions, articles on Canadian, Australian, United States winter resorts, West Africa, etc., are included. There are a number of excellent maps and the information is brought down to date in a very thorough manner. The part which particularly appeals to the writer is the section relating to the Eastern Mediterranean and African resorts. Africa is certainly looking up as a tourist center, and it will be only a question of a very short time when these resorts will be as much appreciated as those of Southern France or Switzerland. The selected tours are all particularly valuable.

QUESTIONS AND ANSWERS ON THE PRACTICE AND THEORY OF SANITARY PLUMBING. Volume II.—Range Boiler Work, Hot Water Supply, and Circulation. By R. M. Starbuck. Hartford, Conn. R. M. Starbuck & Sons, 1910. 16mo.; 154 pp. Price, $1.

For many years the plumbing fraternity has been familiar with the author's "Questions and Answers on the Practice and Theory of Sanitary Plumbing," which in the past has in one volume considered not only the drainage and venting branch of the trade, but also range boiler work, hot water supply, and circulation. In keeping pace with modern improvements, however, the author has thought best to publish the work in two volumes, withdrawing from the original work everything pertaining to hot water supply, and devoting the second volume entirely to that subject in a very exhaustive manner. Its 75 full-page cuts, with 215 separate illustrations, and its list of 200 examination questions will make the book especially attractive.

THE BOOK OF OPERAS. Their History, Their Plots, and Their Music. By Henry Edward Krehbiel. New York: The Macmillan Company, 1910. 16mo.; 343 pp. Price, $1.75 net.

Of making books on operas there is no end, but it is doubtful if there is any one who is better equipped to write a book of this kind than the astute Mr. Krehbiel, whose critical reviews of music in the New York Tribune are famous. The book itself deals with some seventeen operas, and runs the gamut from "Il Barbiere di Siviglia" to "Hänsel und Gretel." It is a far cry from Rossini to Humperdinck, the first being a light opera which has rarely failed to please, while in the latter we find that even a nursery opera must pay tribute to German authors of legends in the same coin used by Wagner when he created his "Ring of the Nibelung," for in truth "Hänsel und Gretel" is an interesting application of Wagnerian theory. The chapter devoted to "Parsifal" is of unusual interest. Throughout the book will be found illustrations of various musical themes and motives, together with illustrations of stage setting, composers, and specimens of the scores. It is a beautifully printed and tastefully bound book. It should be in the library of all music lovers.

CORPORATION LAWS OF THE STATE OF CALIFORNIA FOR 1909. By Charles Forest Curry, Secretary of State. Sacramento: 1909. 16mo.; 859 pp.

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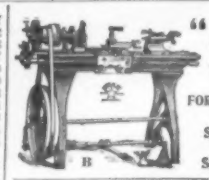

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ECONOMIC VALUES OF WILD BIRDS.

(*Concluded from page 160.*)

the balance destroyed. Wild birds are decreasing to an alarming extent in every part of the United States. Injurious insects, as might have been expected, are therefore on the increase in a similar ratio. So striking has been the increase of insect depredations on fruit trees and growing crops of late years that the appeal of the farmers everywhere for relief is constantly on the increase.

"Scientists are searching every part of the known world for insect-destroying parasites, while millions of dollars are being spent yearly in a vain attempt to check the ever-increasing ravages of these enemies of agriculture, horticulture, viticulture and gardening.

"The menace to successful agriculture is not comprised in insects alone. The rodents and noxious weeds must engage the constant attention of the farmer. Here again the feathered friends of the farmer find ample scope for usefulness to mankind. The hawks, owls, shrikes, and eagles live almost altogether upon the rodent enemies of the farmer, while the seed-eating birds — the sparrows, finches, buntings and grosbeaks—comprise more than one-seventh of the North American species of birds.

"Data gathered by the United States Department of Agriculture show that the annual tax paid to insect depredations exceeds the annual expenditure of the National Government, including the pension roll and the maintenance of the army and navy. In one year a single species of insect—the chinch bug—caused a loss of $60,000,000 and the Hessian fly caused a loss of $24,000,000 in two States in one year.

"The average annual loss to apple-growers from the codling moth is $20,000,000 and millions of dollars are lost each year from attacks of boll weevil, corn-root worm, cotton worm, web worm, canker worm, bark beetle, plant lice, warble fly and hundreds of other creepers and crawlers, each multiplying after its own kind and at the rate of millions a minute and every one of them hungry from start to finish.

"Practically, we are told, every kind of plant has certain insects that naturally feed upon it and tend to hold it in check, and as man produces more of a certain kind of plant nature produces insects to destroy it. In many instances the withdrawal of the natural food of some species of insects forces them to take to another, which may be a cultivated crop.

"It is here that the birds if undisturbed come in to maintain the balance. To kill birds is to allow these insect pests to increase and destroy the cultivated crops to which they have been turned from their natural food."

Already the farm has received more applications for young birds than can be filled in years, and to show the benefits to be derived from them, in the anticipations of many of the farmers, a single instance may be given: Up in Marin County there is a big ranch company owning and operating 11,000 acres of land in a single body, and it is engaged in dairying, cheesemaking and apple growing. One man is employed to ride over the ranch constantly to see that all is running right.

This company was one of the first applicants at the State bird farm for fledglings and it pledged its good faith in caring for the fowls which should be placed under the special care of the overseer.

It is safe to say that this ranch outfit does not desire these birds as future food for the shotgun, but wishes them as friends and as protectors of its crop interests.

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(*Continued from page 161.*)

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(*Concluded on page 169.*)

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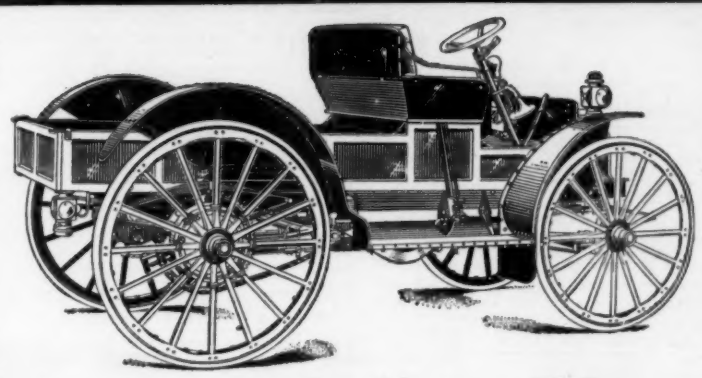

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(Concluded from page 168.)

produces a magnetic field of an intensity of 5,000 gauss. The instrument is suitable for the demonstration of a great variety of magnetic phenomena. The coils are removable and can be used for the study of currents and induction. The production of Foucault currents can be illustrated by causing a disk of copper to rotate or vibrate between the pole pieces and observing the sudden arrest of the movement when the current is turned on (Fig. 2). If the pole pieces are replaced by a single bar, and on of the coils by a coil of finer wire, the instrument is converted into a transformer. Even the frame can be utilized for the suspension of a heavy pendulum for the study of vibration.

The Chassagny electrometer (Figs. 4 and 5) presents the appearance of a mahogany box which rests on a base provided with three leveling screws. The needle of the electrometer is of the usual "8" shape and is suspended between four pairs of quadrantal sectors. It is made of aluminum, is suspended by a torsionless silk fiber and carries a mirror. The vibrations of the needle are damped by a blade which is attached to its lower part, and which dips into a vessel of glycerine resting on a block of paraffine. The sectors rest on a plate of ebony. They are connected together in pairs, and each pair is connected with a binding post. The positive and negative poles of the charging battery are connected with these binding posts and the middle of the battery is connected to earth. Through a large aperture in the door of the wooden case the rays of a lamp strike the mirror and are reflected by it to a horizontal scale.

The Chassagny magnetometer (Fig. 6) is also inclosed in a mahogany case, but two of the walls of this case are made of glass. The astatic pair of needles carries a mirror and is suspended by a torsionless cocoon fiber. The vibrations are damped by a blade dipping in glycerine. The instrument is mounted on a plate supported on three leveling screws. These screws, in turn, rest on three copper plates inlaid in a tripod base, one of the feet of which is also provided with a leveling screw. On one of the copper plates is a small round depression, while the other two are marked with grooves. The feet of the magnetometer rest respectively in the hole and the grooves, so that the instrument can be removed, and replaced in the precise position which it occupied before. In addition to the reading scale, the instrument is provided with a fixed horizontal scale, which, if prolonged, would pass through its center, and carries a sliding piece, to which a small magnet can be attached, longitudinally or transversely. Numerous magnetic measurements can be made with this apparatus. In particular, it makes possible a very simple determination of the horizontal component of terrestrial magnetism, by the method of Gauss.

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Cross-Country Aeroplane Races in France and England.

The conclusion of the great cross-country aeroplane race known as the "Circuit of the East," mentioned in our last issue, was successfully carried out on Wednesday of last week, the last of the three remaining stages being completed on that date by the leading aviators, Le Blanc and Aubrun, both of whom flew Blériot monoplanes. The fourth stage of the race from Mezières to Douai was flown on the 13th under very bad weather conditions; both aviators battled with what was practically a tempest during the greater part of this 86.37-mile stage of the circuit. Le Blanc was more than three hours covering the distance, and was beaten some three-quarters of an hour by Aubrun on this stage. Both aviators were carried off their course many times by the wind, and were obliged to head directly into the wind in order to fly at all. They did not start until 4 P. M., and Aubrun required about 2 hours 20 minutes to cover the distance.

The fifth stage of the circuit, extending from Douai to Amiens, a distance of 48.46 miles, was covered by these two aviators on the 15th inst. in 1 hour 14 minutes 29 seconds and 1 hour 24 minutes and 12 seconds, respectively. The weather was far from ideal, although much better than that experienced during the previous stage. There was a cross wind and considerable fog, but neither affected the aviators to any great extent. MM. Legageneux and Noël had rejoined the race as noncontestants in this stage, the former covering the 48.46 miles in 1 hour 23 minutes 51 seconds in his Farman biplane. The last stage of the race, a distance of 68.35 miles from Amiens to Paris, was flown early in the morning on August 17th by both competitors in 1 hour 28 minutes and 1 hour 51 minutes respectively. The start from Amiens was made by Le Blanc at 5:03 A. M., and he arrived at Issy-les-Moulineaux at 6:31; his total time for the entire distance of about 485 miles was 11 hours 55 minutes and 59 seconds, so that he averaged 40.71 miles an hour throughout the entire trip and under all sorts of weather conditions. Aubrun's total time was 13 hours 27 minutes 14 seconds. His average speed (36 miles per hour) was, therefore, somewhat less than Le Blanc's, although he used a similar machine, viz., a Blériot monoplane.

A large number of spectators watched the finish from the Eiffel Tower, and there was a tremendous crowd at the aerodrome to greet the aviators. This cross-country race for a prize of $20,000 offered by Le Matin has demonstrated the possibilities of the aeroplane for cross-country touring.

The monoplane seems to have won on account of its speed and better stability under tempestuous weather conditions. It seems, therefore, to be a better type of aeroplane in every way. Besides being faster and more stable than the biplane type of aeroplane, it is safer in case of a hasty landing due to an accident, or any other cause, since the motor is in front of the aviator. If the machine plunges to the ground head on, he can throw himself out upon one of the wings and thus have the shock of the fall greatly softened. Furthermore, there is no danger of the motor's falling on top of the aviator, as in the case of most biplanes where the motor is placed behind or beside them.

Latham, the champion of the Antoinette monoplane, made a 75-mile flight from Mourmelon to Paris, circling the Eiffel Tower at an elevation of 1,800 feet, the day before the opening of the "Circuit of the East." He was unable to compete in this great cross-country race, but afterward, on August 16th, he flew from Paris to Amiens. He was obliged to alight en route at La Faloise, but he succeeded in reaching Amiens before nightfall. At the same time a new American aviator, John B. Moissant,

(Concluded on page 171.)

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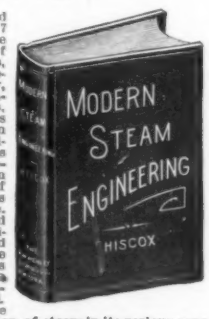

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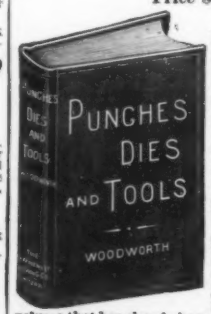

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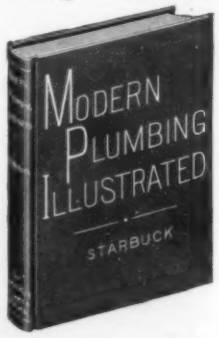

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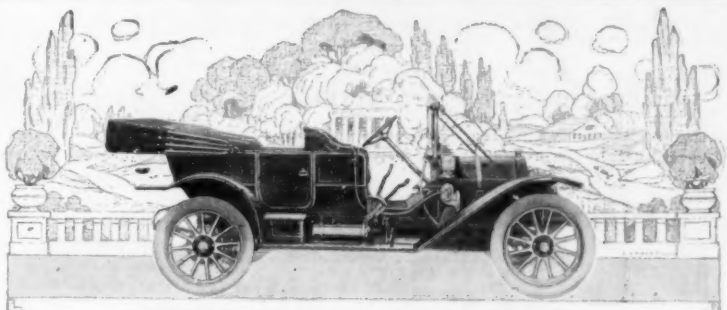

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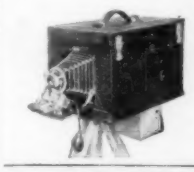

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About a year ago it was decided to open a department in the Scientific American devoted to the interests of the handy man. There was an almost immediate response. Hundreds of valuable suggestions poured in from every part of this country and from abroad as well. Not only amateur mechanics, but professional men as well were eager to recount their experiences in emergencies and offer useful bits of information, ingenious ideas, wrinkles or "kinks," as they are called. Aside from these, many valuable contributions came from men in other walks of life—resourceful men, who showed their aptness at doing things about the house, in the garden, on the farm. The electrician and the man in the physics and chemical laboratory furnished another tributary to the flood, of ideas. Automobiles, motor cycles, motor boats and the like frequently call for a display of ingenuity among a class of men who otherwise would never touch a tool. These also contributed a large share of suggestions that poured in upon us. It was apparent from the outset that the Handy Man's Workshop Department in the Scientific American would be utterly inadequate for so large a volume of material; but rather than reject any really useful ideas for lack of space, we have collected the worthier suggestions, which we present in the present volume. They have all been classified and arranged in eight chapters, under the following headings:

Handy Man's Electrical Laboratory; VII. The Handy Man About the House; VIII, The Handy Sportsman; IX, Model Toy Flying Machines. Index.

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(Concluded from page 170.)

started in his Blériot monoplane and raced Latham. Moissant carried a mechanic and made the flight from Paris to Amiens in 2 hours. The next day he continued from Amiens to Calais, covering the distance (75 miles) in 2 hours 6 minutes. Latham met with an accident on leaving Amiens the next day, and was put out of the race, which was from Paris to London. After reaching Calais, Moissant started to cross the Channel at 10:45 A. M. on August 17th, accompanied by his mechanic. In spite of the fact that there was a strong wind blowing and the voyage was deemed unsafe by experienced aviators, the young Chicagoan made the trip successfully and passed over Walmer Castle, near Deal, at 11:15 A. M. He landed near Tilmanstone, having accomplished the trip in 37 minutes. This is the first time the Channel flight has been made with a passenger.

The following day Moissant attempted to fly to London, but his machine broke down and he was obliged to alight twice; the second time he was within 30 miles of his destination, and owing to the breaking of a connecting rod in the motor, he made a hasty descent in a brickyard at Rainham, Kent. He broke the propeller and chassis of his machine, and was obliged to send to Paris for new parts. He expects to secure them within a day or two and will undoubtedly complete the journey and win the substantial prize which was offered by a London paper for this 250-mile flight.

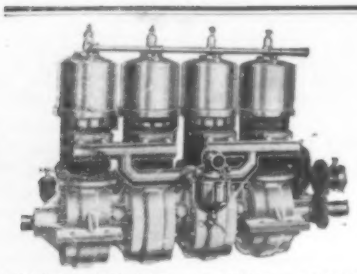
Berlin's New Postal Subway.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Some recent information has been obtained about the new underground postal railway which it is proposed to construct in Berlin. The project has been on foot for several years past, and it now seems likely to be carried out, as the Siemens-Schuckert firm has taken the matter in hand and has designed an experimental line which is already built and is under trial. This line will serve as a model for the final construction. A double track subway is used, and the gage is 1 foot 5 inches. The length of the present experimental section is about 1,300 feet, and it uses an electric locomotive working upon three-phase current at 200 volts coming from an overhead trolley line. The small locomotives are about 5 feet in length and 1 foot 6 inches high, and they are designed to take a train for four small cars, each carrying a mail sack. Such trains will be run at a moderate speed of 25 miles an hour. As to the actual subway which is planned for Berlin, the project has not as yet been fully decided upon. The three main points will be the present and the new central post-office and the Potsdam railroad depot. The subway tunnel is designed to have 6 feet 6 inches width and 2 feet 8 inches height. Between the two tracks there is a deep trench which allows the employees to circulate within the tunnel. The locomotives will not be run by a motorman, but will work on an automatic system. One source of heavy outlay in building the line lies in the fact that it must pass under the Spree in two different places.

Who Invented the Word "Blizzard"?

Mr. C. Fitzhugh Talman, of the United States Weather Bureau, who is compiling a dictionary of meteorological terms, including popular as well as scientific expressions, pertaining to weather and climate, requests such readers of the SCIENTIFIC AMERICAN as may have access to files of old newspapers to seek therein for early examples of the use of the word "blizzard," in its application to a violent cold wind, accompanied by snow. This word came into general use, in its meteorological sense, in the winter of 1880-81; but the earliest example heretofore reported is in the Dakota Republican, published at Vermilion, Dakota, dating from the winter of 1867-68.



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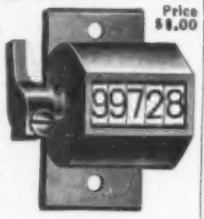

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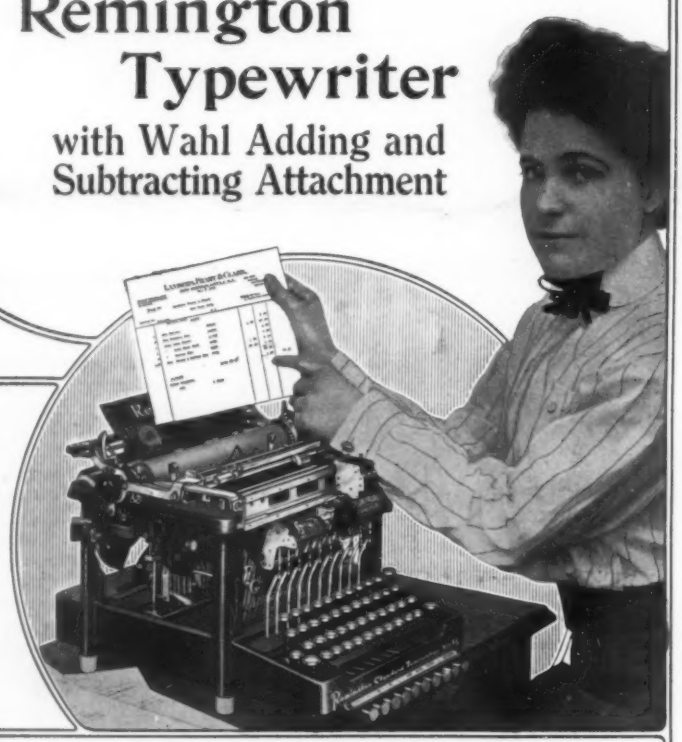

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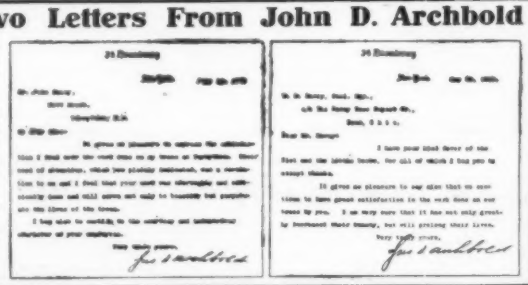

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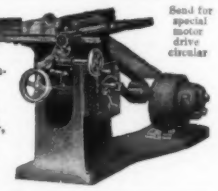

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